A Study of Bitcoin Stock Market Prediction: Methods, Techniques and Tools

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***Abstract*—Bitcoin is a kind of Cryptocurrency and now is one of type of investment in the stock market. Stock markets are influenced by many risk of factor. And bitcoin is one kind of cryptocurrency that keep rising in recent few years, and sometimes fall without knowing influence behind it, on stock market . Because it’s fluctuations, there’s a need Autamoted tool to prediction of bitcoin on stock market. This research study learn how to make bitcoin stock market prediction, method to apply on predictiom and also technique and tools that used from previous research paper, many authors, web-sources and other available sourcs. For the last section we discussed and make conclussions to provide good method on future works.**

*Index Terms*—Cryptocurrency, Bitcoin, Bitcoin Stock Market Prediction, Stock Market

# **Introduction**

Cryptocurrency has been around for several years and has now become quite popular, widespread, and also surrounded and there is a lot of controversy from innovative developments.

Cryptocurencies is a digital currency where transactions can be done by online transactions, unlike common currency, cryptocurrency is designed based on cryptography.

Bitcoin is one kind of Cryptocurrency no regulation from any party and decentralized. and now is one of type of investment in the stock market and bitcoin also . The one of unique characteristics of Bitcoin is daily price fluctuations and always change everyday. The value Bitcoin Exchange rate to (USD) is $3868 USD on march 2019 in yahoo finance stock market[1].

The Stock markets are influences by many uncertainties factor such as political issue, economical issue at impacted to local or global levels. To interpretation key of success factor for provide accurate predictions is complicated work as we mention before this. For the market we can analyzed with many technique such as technical indicator, price movements, and market technical analysis.

To solve the problem above , there’s a need a tool for predictoon to help investors decide for bitcoin or other cryptocurrency market investment. Nowadays the automation tools are usually used in common stock market predictions, and we can do the same works and strategy on this domain cryptocurrencies.

This paper studies about bitcoin and stock market predictions, method, technique and tools from big number of resources paper, and other available sources.

# **Literature Review**

## Cryptocurrency and Bitcoin

The history of cryptocurrency (Cryptographic currency) is began in the 1980s started with David chaum, his paper on cryptographic primitives of blind signatures. In his paper he proposed a novel of cryptographic scheme to blind the content of message before it is signed, so that the signer cannot determine the content. These blind signatures can be publicly verified just like a regular digital signature. Chaum proposed digital cash approach in such a way that is untraceable by another party. [2]

The rise of cryptocurrency started on B-money In 1998, Wei Dai proposed b-money[3], an anonymous and distributed electronic cash system, In that method describes two protocols based on network that cannot be traced, where senders and receivers are identified only by digital such as their public keys, and each message will signed by its sender to receiver.

Bit Gold In 1998, Nick Szabo[4] propose models a new digital currency, the models based on cyprtographic system puzzles, which after being solved, were sent to byzantine fault tolerant public registry and assigned to the public key of the solver.

Hashcash provosed by Adam Back, Haschash, a system relied on cryptographic hash function to derive probabilistic proff of computational work as authentification system Pow (Proof of work)[5]

And the last is RPOW Hal finney propose currency system based on a reusable proof of work (RPOW) in 2004[6].

Between 2008 and 2009, Bitcoin was made as the firsas the first decentralized cryptocurrency by Satoshi Nakamoto. Nakamoto published the Bitcoin whitepaper in 2008[7] , and after January 3rd 2009, the genesis block of the bitcoin protocol was created. Nowadays it is most successful cryptocurrency in terms of market capitalization, beside above 700 altcoins that circulated in the world (eg. Litcoin, Etherum) based on Bitcoin have been proposed since the launch of Bitcoin.

## Stock Market Investment

The Growth of cryptocurrencies increases interest in the

study of economic dynamics and financial characteristics. Bitcoin data transaction is available from several online sources including Coindesk, Datastream, yahoo finance, google finance Blockchain.info and any other common or local stock exchange.

In Indonesia they have Indodax that provide transaction data of bitcoin, in Malaysia they have localbitcoin and remitano both of them based on local currency exchange .

Tae kyun klee et al. 2019 in paper, they describes about four levels strategies of investments such as : From perspectives macro to micro, such as security selection, asset allocation, regional allocation, and country selection, and. Between these strategies, the first two strategies commonly apply for global stock investment. [8]

Because the stock market accounts for majority of the risk assets,stock market predictios are very important. However, betting on the direction of stock markets is considered a high-risk strategy because there are too many external factors that influence it.

## Overview of Bitcoin Predictions

The Bitcoin value just like a common currency on stock market although differently. In any case the indicators that affecting bitcoin are different from common stock exchange, because it is decentralized and no regulated by any party. But it is important to predict the value of Bitcoin for investor to made decisson for correct investment .

The Price of Bitcoin also does not depend on the business issue of interventing by government unlike common stock market because it’s not depend on any party. To predict value we can use machine learning technology to predict price of bitcoin.

## Bitcoin Predictions Methods, Technique and Tools

There are many people doing research about prediction of cryptocurrency. Greaves et al. [9] is propose technique using Logistic Regression and SVM and analyzed using Graph to predict the price of bitcoin. Huisu Jang et al. [10] they concern about study on modelling and prediction bitcoin with Bayesian Neural Network and giving some knowledge about bitcoin. Edwin sin et al. [11] provide topic Bitcoin price predictiom using Ensemble of Neural. Networks. Arief Radityo et al.[12] proposed a prediction of bitcoin using Artificial Neural Network Technique. They combine with market technical indicators but the results is worse of performance and training time. Sean et al [13] They propose method the price of Bitcoin using RNN and combine Using Reccurent Neural Network and Long Short Term Memory and Ruchi Mittal et al [14] is propose an Automated cryptocurrencies prices prediction using machine learning technique based on historical trend (daily trend).

The above researches proposed various method to prediction for bitcoin. However there are some shortcomings: (1) Most of the studies not analyze on trend just on price not on the signal trend in the market .(2) Some of the result it’s not provide to investors or trader to analyze the market.

In this paper, we analyze and study of knowledge about bitcoin, stock market and method , technique and tools to predict about Bitcoin from many papers, internet and any other source.

# **An Analysis of Bitcoin Stock Market (BSM) Prediction**

## BSM Predictions

Technically Bitcoin stock market prediction it’s the same with prediction technique on common stock exchange but in the other way, when you try another technique and strategy like sentiment analysis maybe we can’t get different results or the strategy it’s not work. Because beside many factor that impact on stock exchange prediction, Bitcoin it’s decentralized and not regulated by any party so it’s different from common currency or common stock market.

We can use same algorithm to Bitcoin prediction using Machine Learning (eq. SVM, Naïve bayes, Regression) [9][10] or any other Advance Machine learning technique to improve the results like Deep Learning using Neural Network (eq. ANN and RNN)[12]

On Prediction we can predict Bitcoin using technique on specific subject that we wanted. Example, we want to predict only by the signal or the price, or we can predict just for current day or next day close value based on Long Short Term Memory (LSTM),[14] historical price and other technique like regime prediction to detect current day’s trend on market, to help investor to making decision to investment.

## BSM Methods and Techniques

To make more accurate and enrich the result we can combine the prediction algorithm with another method or technique on prediction Bitcoin

In this section we describe some of technique that mention on previous research on some papers.

**Market technical analysis** is is a method that studies price movements by looking at historical price data that occur in the market through media charts. By studying this historical data a conclusion can be drawn for making investment decisions in the market.

There are several reasons why we should use TA, the first, not necessarily fundamental analysis can be applied in trading. I do not say Fundamental is not important, but here that needs to be underlined fundamental analysis will be far more important if our position as an Investor where the investment period can take more than one year.

Secondly, with the media chart it will be seen how the journey of a stock price where it is very helpful for traders to analyze in anticipation of future price changes and see patterns of patterns that occur in the price movements of a stock, so traders do not trade in ' darkness or without clear direction.[15]

Another technique to interpretation trend is **Technical Indicator** [16]is a series of data points obtained by applying the formula to securities price of data. The combinations of price data, such as close, low, high, low and open can be used as data point certain period of time. Some indicators can only be use on opening or closing prices, The price data is entered into the formula and a data point is produced. For Example, the average of 3 closing prices is one data point ((35200+25300+27550)/3=29350).

A comparison can be made between present and past levels by creating a time series of data points. For analysis technical indicators are usually used to refine data points and displayed in a graphical form above or below by price, value and signal chart [9]. For maximize the dataset and predict some technical indicators such as simple moving average (SMA) is one of the simplest types of Moving Averages indicators for trading. Basically, the Simple Moving Average is calculated by summing the last few closing prices, here I call X period, and then dividing the amount by X. The result will be a moving average that changes over time, as long as prices are still raised by the market. Parabolic SAR (Stop and Reverse) method to find potential reversal in the mrket price prediction, Correlation (Corr) is a statistic that measures the degree to which two securities move in relation to each other, Average Directional Index (ADX) developed by J. Welles Wilder, is an indicator that can be used to determine the movement of when the market is trending, and how strong or weak the trend is and when the trend is likely to start or end [17], and Relative strength index (RSI) is an oscillator indicator with the lowest range (0) to the highest range (100). A range below 30 is called an oversold area and a range above 70 is called an overbought area.[18]. The advantages of using technical analysis it is used buy approximately 90% of the majir stock tradersm and it is also used to analyze the stock for shorter period.

**Time series Data Analysis** in the terms of future price predictions popular methods is using Autoregressive integrated moving average (ARIMA) models are a popular choice for forecasting over a short term conditions, it works when data exhibits consistent or stable pattern (constant) over time with least possible outliers. But this is not work always in the real time scenario , where data fluctuated drastically and it is highly volatile.[19]

**Trading Strategy** , this strategy is that we maintain position of +1 Bitcoin, 0 Bitcoin or −1 Bitcoin. At each time we predict the average price movement over the 10 seconds interval, say ∆p, using Bayesian regression (if ∆p > t, a threshold, then we buy a bitcoin if current bitcoin position is ≤ 0; if ∆p < −t, then we sell a bitcoin if current position is ≥ 0; else do nothing. The choice of time steps when make trading decisions as mentioned above are chosen carefully by looking at the recent trends. [20]

## BSM Tools

Bitcoin Stock Market Prediction Tools based on previous

Research have increased from 2014 until 2019 many tools produces from authors that proposed using machine learning algorithm combine with some technique that we mention before.

Their using many open source tools to produce the automated tools to bitcoin prediction, (Eq. Python, R, Weka, and Mathlab)

From Alex Greaves et al. 2015 , their reseach propose prediction method using transaction graph to predict the price of bitcoin, their colled data from CS224 Website, and using feature Extraction and using SVM algorithm and Linear Regression to provide the results.

|  |  |
| --- | --- |
| Regression Model | MSE |
| Baseline | 2.02 |
| Linear Regression | 1.94 |
| SVM Regression | 1.98 |

Tabel 1 Regression results

|  |  |
| --- | --- |
| Classification Model | Accuracy |
| Baseline | 53.4% |
| Logistic Regression | 54.3% |
| SVM | 53.7% |
| Neural Network | 55.1% |

Table 2 Classification results

Based on table 1 and 2 , we have different results provide from the author the first on regression model, the baseline have good result behind. Linear or SVM, and for classifcations the accuracy reach by Neural Network 55.1% by percentage.

Hiusu jung et al. 2017, the authors provide empirical study and prediction of bitcoin using Bayesian neural network, and the result BNN give accurate prediction .

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Response Var. | | Log Price | | Log Volatility | |
| Num . of Input var. | | 26 | 16 | 25 | 16 |
| Linear  Regression | RMSE | - | 0.0913 | - | 0.4595 |
| MAPE | - | 0.0681 | - | 0.5905 |
| Bayesain  NN | RMSE | 0.0031 | 0.0047 | 0.1612 | 0.1717 |
| MAPE | 0.0119 | 0.0148 | 0.33.14 | 0.3512 |
| Support Vec. Regression | RMSE | 0.1453 | 0.1434 | 0.3810 | 0.3939 |
| MAPE | 0.0325 | 0.0322 | 0.5411 | 0.6293 |

Tabel 3 Trainning error for the bitcoin price information

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Response Var. | | Log Price | | Log Volatility | |
| Num . of Input var. | | 26 | 16 | 25 | 16 |
| Linear  Regression | RMSE | - | 0.0935 | - | 0.4823 |
| MAPE | - | 0.0712 | - | 0.6263 |
| Bayesain  NN | RMSE | 0.0039 | 0.0069 | 0.2546 | 0.2325 |
| MAPE | 0.0138 | 0.0180 | 05090 | 0.5222 |
| Support Vec. Regression | RMSE | 0.3201 | 0.2742 | 0.5487 | 0.5297 |
| MAPE | 0.0428 | 0.0404 | 0.7232 | 0.8629 |

Table 4 Test error for the bitcoin price information

Based on table 3 From this results, we can confirm that Bayesian NN is show good result and better apply for the Bitcoin prediction. time series analysis and Support vector regression shows not good performances in both training and test phase.

Arief Radityo et al. 2017, the authors provide prediction of bitcoin exchange rate using Artifical neural network combine with technical analysis and this is the results

|  |  |  |
| --- | --- | --- |
| Methods | MAPE % | Training Time (seconds) |
| BPNN | 1.998 ± 0.038 | 347 ± 63 |
| GANN | 4.461 ± 0.49 | 467 v 345 |
| GABPNN | 1.883 ± 0.066 | 1539 ± 558 |
| NEAT | 2.175 ± 0.096 | 470 ± 363 |

Tabel 5 Experiment result Arief radityo

From Table I, the result shown that GABPNN has the best accuracy with average of MAPE 1.883%. The worst accuracy is GANN with average MAPE 4.461% and GABPNN has the longest training time.

Sean Mcnally et al. 2018 provide method prediction bitcoin using Bayesian optimised recurrent neural network (RNN) and a Long short term memory (LSTM).the LSTM achives the highest classification accuracy above 52% and a RSME of 8%

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Model | Length | Precision | Accuracy | RMSE |
| LSTM | 100 | 35.50% | 52.78% | 6.78% |
| RNN | 20 | 39.08% | 50.25% | 5.45% |
| ARIMA | 170 | 100% | 50.05% | 53.74% |

Table 6. Model Results

# **Future Directions Of Bitcoin Stock Market (BSM) Prediction**

Future direction that we suggested from the previous research, based on the result shown good results but not good enough there are many disadvantage that we found from the previous research, from the Greaves et al, accuracy just above 55% and the future direction will be include feature (eq. Feature selection or extraction), on Hiusu jang BNN can give good prediction but not enough results, future directions is try to adopting extended machine learning methods.

On Edwin sin et al. future direction should be optimal subset of input features to provide best prediction accuracy

On Arief Radtiyo et al, their suggest about combine with fuzzy or SVM algorithm and optimize the dataset, or optimize the algoritym because worst accuracy and longest training time.

On Sean et al, their suggest to improve the model , shrouded the noise and pruning the variables.

From the suggestion above, we can make conclusion on the future direction will be optimize the dataset shrouded the noise, use some feature, and make shorter training time, combine with some technique and algorithm (Hybrid methods) to provide new best result.

# **Conclusion and Future Works**

From some previous research paper their produce good results and good techniques to provide bitcoin prediction to help investor to make decision of investment on stock market.

With various algorithm and various results, in the Arief radityo research they tried to combine Advance technique using deep learning and combine with market technical analysis , the result is more rich than other, but disadvantage their not mention the result is good or not to help investor to make decision, maybe because their using MAPE to evaluate the results, on future reseach we can combine using signal prediction based on technical indicator so the investor can decide where is the good time to investment.

Many problems from previous research is longer training time, many noise or nan values on the research, so on future we can maximize this features, to optimize the dataset and shrouded the noise, and optimised the algorithm to make shorter training time.

Future works will be , the direction will be optimize the dataset shrouded the noise, use some feature, and make shorter training time, combine with some technique and algorithm (Hybrid methods) we can select from the previous research that provide good results, (Eq. BNN, SVM , Linear regression, and Deep learning technique) to provide new best results.

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# References

[1] B. U. (BTC-USD) and C.-C. C. in USD, “Yahoo Finance,” 2019. [Online]. Available: https://finance.yahoo.com/quote/BTC-USD?p=BTC-USD. [Accessed: 14-Mar-2019].

[2] A. Judmayer, N. Stifter, K. Krombholz, and E. Weippl, “Blocks and Chains: Introduction to Bitcoin, Cryptocurrencies, and Their Consensus Mechanisms,” *Synth. Lect. Inf. Secur. Privacy, Trust*, 2017.

[3] W. Dai, “B-money proposal,” *White Pap.*, 1998.

[4] N. Szabo, “Bit gold,” *Website/Blog*, 2008.

[5] A. Back, “Hashcash.” 1997.

[6] H. Finney, “Reusable proofs of work (rpow).” 2004.

[7] S. Nakamoto and others, “Bitcoin: A peer-to-peer electronic cash system,” 2008.

[8] T. K. Lee, J. H. Cho, D. S. Kwon, and S. Y. Sohn, “Global stock market investment strategies based on financial network indicators using machine learning techniques,” *Expert Syst. Appl.*, vol. 117, pp. 228–242, 2019.

[9] A. Greaves and B. Au, “Using the bitcoin transaction graph to predict the price of bitcoin,” *No Data*, 2015.

[10] H. Jang and J. Lee, “An Empirical Study on Modeling and Prediction of Bitcoin Prices With Bayesian Neural Networks Based on Blockchain Information,” *IEEE ACCESS*, vol. 6, pp. 5427–5437, 2018.

[11] E. Sin and L. Wang, “Bitcoin Price Prediction Using Ensembles of Neural Networks,” in *2017 13TH INTERNATIONAL CONFERENCE ON NATURAL COMPUTATION, FUZZY SYSTEMS AND KNOWLEDGE DISCOVERY (ICNC-FSKD)*, 2017, pp. 666–671.

[12] A. Radityo, Q. Munajat, and I. Budi, “Prediction of Bitcoin exchange rate to American dollar using artificial neural network methods,” in *Advanced Computer Science and Information Systems (ICACSIS), 2017 International Conference on*, 2017, pp. 433–438.

[13] S. McNally, J. Roche, and S. Caton, “Predicting the price of Bitcoin using Machine Learning,” in *Parallel, Distributed and Network-based Processing (PDP), 2018 26th Euromicro International Conference on*, 2018, pp. 339–343.

[14] R. Mittal, S. Arora, and M. P. S. Bhatia, “AUTOMATED CRYPTOCURRENCIES PRICES PREDICTION USING MACHINE LEARNING,” 2018.

[15] J. J. Murphy, “Technical Analysis Of The Financial Markets,” *Pennsylvania Dental Journal*. 1999.

[16] E. Kristensen, S. Østergaard, M. A. Krogh, and C. Enevoldsen, “Technical Indicators of Financial Performance in the Dairy Herd,” *J. Dairy Sci.*, 2008.

[17] J. W. Wilder, *New concepts in technical trading systems*. Trend Research, 1978.

[18] Investopedia, “Trading Strategy,” 2018. [Online]. Available: https://www.investopedia.com/. [Accessed: 14-Mar-2019].

[19] C. Scheier and W. Tschacher, “Appropriate algorithms for nonlinear time series analysis in psychology,” in *Nonlinear dynamics in human behavior*, World Scientific, 1996, pp. 27–43.

[20] D. Shah and K. Zhang, “Bayesian regression and Bitcoin,” in *2014 52nd Annual Allerton Conference on Communication, Control, and Computing (Allerton)*, 2014, pp. 409–414.