

A Brief Perusal on Bitcoin Price Prediction using Artificial Neural Networks

Prachi Vivek Rane¹ and Sudhir N. Dhage²

¹ Sardar Patel Insititue of Technology, Mumbai, India

² prachi.rane@spit.ac.in

³ sudhir.dhage@spit.ac.in

Abstract. According to economy metrics, Bitcoin and other cryptocurrencies has burgeoned in the financial market. Bitcoin being the first decentralized digital cryptocurrency has attracted significant growth in market over last few years. It is crucial to understand the volatility of the Bitcoin exchange price to forecast future prices. In this paper, we analyze the daily trends in Bitcoin system, user behavior, and emphasize on the dynamics showing volatility. Transaction data is collected from January 2014 to March 2019. The proposed model outperforms the machine learning technique along with timeseries statistical models. Empirical results of Bitcoin prices with utilization gives the ability to train model in predicting prices. The accuracy of the price prediction is done in USD. The parameters of prediction are compared in order to bring out the best solution to forecast prices and to improve the predictive performance of Bitcoin prices.

Keywords: Bitcoin · Bitcoin price prediction · Cryptocurrency · Machine Learning.

1 Introduction

Cryptocurrency is an another form of digital or virtual currency specifically designed as a medium of exchange to secure and verify the transactions. The prices of Bitcoin were soaring leading to increasing number of transactions involving payments, Bitcoin was the first global cryptocurrency which was introduced by Satoshi Nakamoto (a pseudonym for a person or a group whose identity is mystery) in January 2009. The Bitcoin system is completely decentralized, and all the transactions take place in peer-to-peer network. Bitcoin has topped the list of cryptocurrencies followed by Ethereum, Ripple, Bitcoin Cash, Litecoin. Bitcoin has total value of 3.069 billion. The properties of Bitcoin such as transparency and anonymity has made it topped all the charts of cryptocurrency. The popularity of Bitcoin is not just limited to online stores but rather it is being accepted by offline business as well.

A simple way to accomplish the transaction to be validated is to require proof-of-work [1], which is created with computational power. In a closed network, virtual currency is stored in a digital wallet (either in a Cloud or on Users

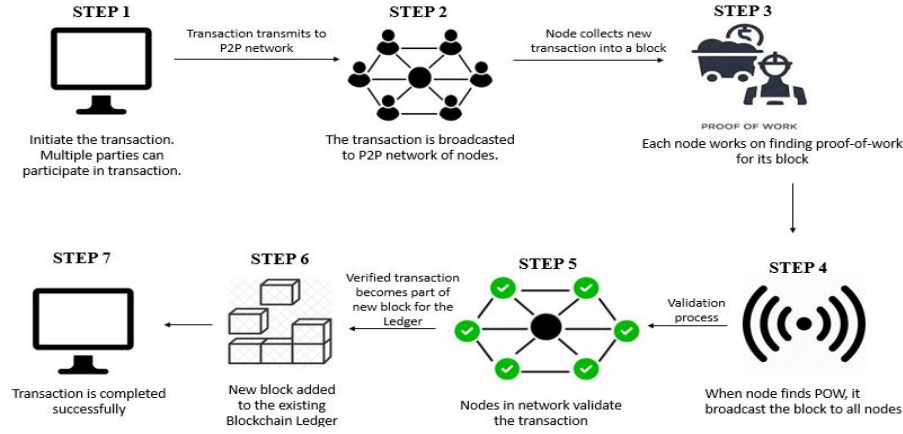


Fig. 1. Working of Bitcoin Transaction.

Computer). Bitcoin mining is done by users known as Miners. Miners [2] validate nodes in the network and record transactions. As Bitcoin accounts does not identifies miners and there is no central authority to provide details, transaction is done anonymously. Every 10 minutes these new transactions are secured, also known as hashed, into a new block. Once a miner successfully finds a hash for the block, proof-of-work is achieved then the miner broadcasts the block chain that includes addition of block to the existing blockchain public ledger. Other miners validate the authenticity of the transactions and check the hash, this new block is then added to the blockchain ledger, and the race to mine the next block begins. Computers participating in the system must solve a cryptographic puzzle to come up with a desired answer. Once they solve this puzzle, the transaction is recorded in the Blockchain. Bitcoins uniquely set payout rate which rewards miners for supporting the network with their computers also helps make it more valuable. The sender and the receiver create network, public keys are exchanged to start the transaction. The private key is exchanged to send the specific amount to the receiver. Private key generates the digital signature for authentication of sender, receiver and transaction. The Bitcoin system is capable of 7 transactions per second. Bitcoin is widely accepted by over 40 countries such as Germany, Croatia, Switzerland, Canada etc. as cryptocurrency.

The paper proceeds as follows. The next section explains literature survey. The subsequent spotlights on methodology. The following section shows the results obtained from the methodology. The last section offers concluding thoughts.

2 Literature Survey

Price is predicted using Fundamental Analysis and Technical Analysis. Fundamental Analysis observes volatility of economy and helps in decision making of

prices in cryptocurrency. Technical Analysis studies the market data for prediction of prices. [3] In paper [4], data being predicted in graph, various features are extracted to predict the value on time-frame of 1-hour, 1-day, 1-week, 1-month basis. Within the selected features the Union Find algorithm is used to remove the redundancy and to find the unique entity of a person. Machine learning algorithms such as Linear Regression, Support Vector Machine, Neural Network (Feed-Forward Neural Network), Logistic Regression are applied on the dataset. The author tried to forecast Bitcoin prices in USD, 1-hour prior along with the accuracy rate of 55%.

Latent Source Model (LSM) was developed by G. H. Chen for binary classification. [6] In this paper, Bayesian Regression is used for predicting the varying price of Bitcoin. In Bayesian Regression, data acts as proxy for Bayesian inference. The problem of unknown labels is resolved with use of training data for prediction. Latent Source Model in conjunction with Bayesian Regression examines the existing patterns in system, human behavior for prediction of prices with higher accuracy instead of doing explicitly. The average price is predicted at an interval of 10 second with the help of trading strategy which allows the user to make the decision. Using Sharpe ratio, it is observed that trading strategy performs consistently over time and yields better results during high volatility.

The relationship between Bayesian Structural Time Series Approach and various factors affecting Bitcoin prices is explained. The important feature of State Space Model (SSM) is forecast the prices into diverse components. [7] Cross-industry standard process for data mining (CRISP-DM) is processed for data mining.[8] Activation functions works best with Sandardisation for deep learning models. Here feature extraction is done with Boruta, Deep learning parameters are selected on the basis of random search, genetic algorithms and grid search.

3 Methodology

Fig. 2 explains the procedure of the implementation of proposed model. The model has three phases for the entire implementation. The Data Compilation phase collects the data from various sources to validate the data before processing. The Data Preparation phase filter the imputed values for the final processing. The final phase includes the model implementation.

3.1 Data Compilation

To accomplish the target of prediction we acquire the dataset that adequately represents the presently existing Bitcoin system, various online sources are available to obtain the data. The data is collected from Coinmarketcap. The data ranges from January 2014 to March 2019. There are total 1932 instances in the data. The transactions are verified and the parameters needed for the prediction are validated. The complete historical listing of Bitcoin prices enable us to explore various features of price prediction. The parameters that are taken into

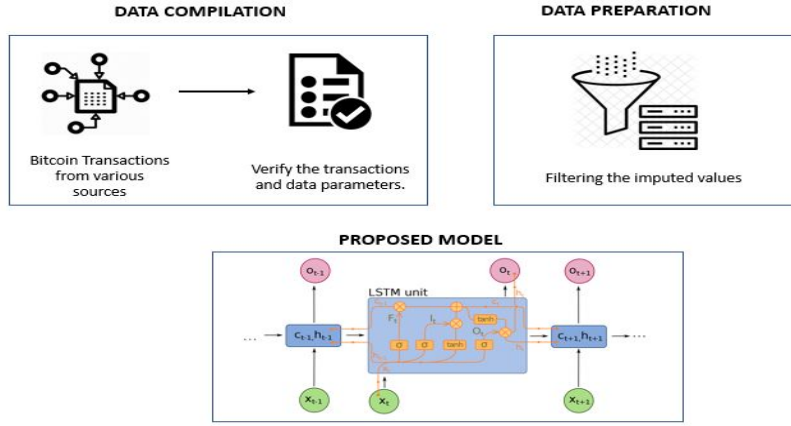


Fig. 2. Procedure of Bitcoin Price Prediction.

consideration while implementing model are Open, Volume, Close, Low, Market Cap, High. From the acquired transactions, we have computed the average price of Bitcoin and forecast on daily basis.

3.2 Data Preparation

Bitcoin Ledger has each and every record of Bitcoin transaction which uniquely analyzes the volatility in prices. The filtering phase includes the conversion of values into integers by removing commas. In next phase the values are selected by excluding the missing or incorrect values. This helps to improve the prediction more efficiently. Based on the classification of data and focus, we choose the parameters in aspect of regression in-order to gain high accuracy in prediction.

3.3 Proposed Model

Long-Short Term Memory Model is implemented to forecast the Bitcoin prices. Important parameters are used chosen for regression to predict the prices with higher precision. The parameters of each model are optimized on a daily basis to forecast the next day change in price of Bitcoin. Two evaluation metrics are used for parameter optimization: Mean Absolute Error (MAE), Root mean squared error (RMSE). MAE computes the absolute variation of test sample between predicted value and the actual value having equal weights whereas RMSE computes square root of the average of squared differences between prediction value and actual value.

Various other models based on prediction are explored and compared their performance to interpret which technique is better and to what extent. Accuracy level obtained from the models enhance to overcome the drawbacks of the existing systems.

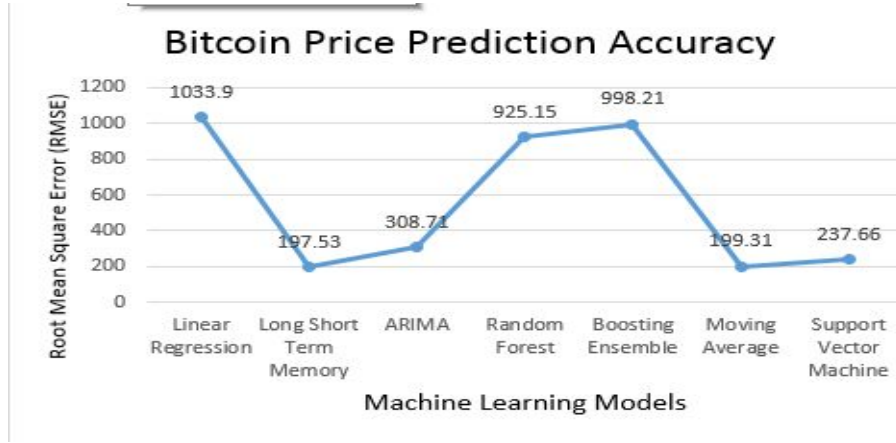


Fig. 3. Bitcoin Price Prediction Accuracy Comparison with other Machine Learning models.

4 Results

The use of Bitcoin continues to grow, despite the regulation uncertainties shared across many countries permitting its use. To increase the adoption of Bitcoin, pragmatic companies continue to deliver applications that are useful to the people. Moreover, we test to what extent market liquidity has impacted the estimated scaling exponents. According to the results, we choose to follow further modelling of values rather than intricate patterns. Although there exist a lot of volatility in the prices from the data, the tail behavior seems to be a common generality. The results derived from the proposed model show that Bitcoin price prediction can be used to enhance the growth in the industry and attract more miners to invest in the system.

Fig. 4 enables us to understand the the predicted prices and the actual prices of accuracy. The graph is so close meaning the accuracy is very sharp.

5 Conclusion

Bitcoin system demonstrates that competition in bitcoin mining done by the miners leads to a great challenge in forecasting the future prices. Due to absence of regularity in the Bitcoin market, the forecasting of the accurate prices has become a challenging task. The model was developed as a proof of concept and to demonstrate its feasibility, other functionalities can also be added to it to become a fully functional system that can be used be people. A different yet promising approach to examine cryptocurrencies such as Bitcoin system consists in quantifying the impact of effective predictors of Bitcoin, price fluctuations, market behavior. Future research might includes further exploration in the structure of Bitcoin network and how stabilize the volatility in the network.

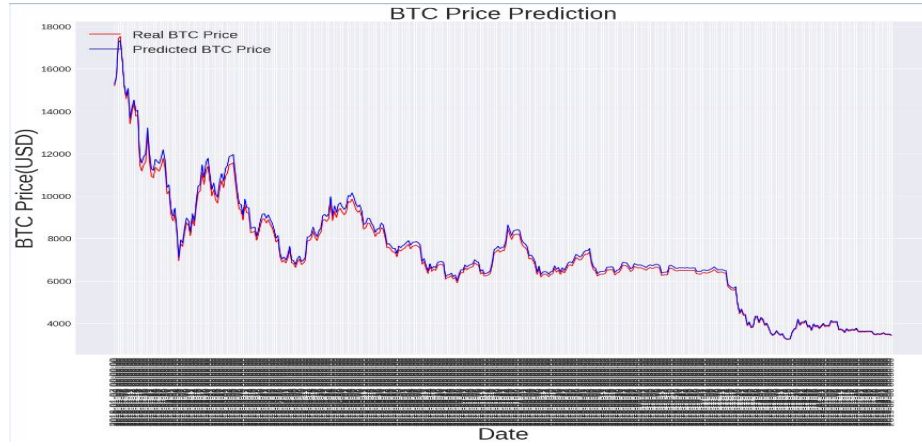


Fig. 4. Prediction of Bitcoin Prices using Long-Short Term Memory model.

This paper an overview on the fast emerging Bitcoin system highlighting mainly the volatility of prices inherent to these technologies. Broadening the current analysis of price prediction by considering other parameters of the market is a scope for future work. The aim of the paper is to explore Bitcoin system theoretically and empirically build a model from the perspective Bitcoin cryptocurrency market by predicting price with higher accuracy.

References

1. S. Nakamoto, "Bitcoin: A peer-to-peer electronic cash system", 2008.
2. Luqin Wang, Yong Liu, "Exploring Miner Evolution in Bitcoin Network", NYU Polytechnic School of Engineering, Brooklyn, USA.
3. Abhyudit Bisht, Puru Agarwal, "Analysis of Bitcoin using Linear Regression and Data Mining Techniques", *International Journal of Advanced Research in Computer and Communication Engineering (IJARCCE)*, SRM University Chennai India, vol. 6, Issue 11, November 2017.
4. Alex Greaves, Benjamin Au, "Using the Bitcoin Transaction Graph to Predict the Price of Bitcoin", December 2015.
5. Tian Guo, Nino Antulov-Fantulin, "An experimental study of Bitcoin fluctuation using machine learning methods", *Association for Computing Machinery*, Zurich, Switzerland, June 2018.
6. Devavrat Shah, Kang Zhang, "Bayesian regression and Bitcoin", *IEEE Fifty-second Annual Allerton Conference, Illinois, USA*, Laboratory for Information and Decision Systems, Department of EECS, Massachusetts Institute of Technology, October 2014.
7. Obryan Poyser, "Exploring the determinants of Bitcoins price: an application of Bayesian Structural Time Series", *Thesis*, June 2017.
8. Sean McNally, Jason Roche, Simon Caton, "Predicting the Price of Bitcoin Using Machine Learning", *26th Euromicro International Conference on Parallel, Distributed, and Network-Based Processing*, Ireland, 2018.