

A Random Forest Approach to Navigating Cryptocurrency Market Fluctuations

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Abstract

This study looks at the main elements influencing daily price variations to improve our analysis and prediction of Bitcoin values. Our forecasting algorithm is based on comprehensive data that we have collected and analyzed over the last few years. Because the Random Forest algorithm provides more accurate forecasts than previous techniques, that is why we chose it. Predicting the price swings of cryptocurrencies, like Bitcoin, can be challenging due to market volatility, despite their increasing popularity as investments due to their decentralized nature and high return potential. Our method assists in addressing these challenges by providing investors, both novice and seasoned, with improved instruments to predict price fluctuations and make more informed investment choices.

Keywords: Bitcoin, cryptocurrency, data analysis, random forest algorithm, machine learning

INTRODUCTION

In contrast to traditional money managed by central banks, Bitcoin is a revolutionary cryptocurrency that was first created with a distinctive design by Nakamoto. Its goal is total decentralization. It makes use of a technology known as Blockchain, which establishes user trust using cryptographic methods and hash functions. Bitcoin's novel approach has attracted interest from a wide range of sectors, not just economics, including machine learning and encryption. Lately, scientists have been attempting to comprehend how the price of Bitcoin changes over time. They examine the volatility of Bitcoin prices using techniques such as GARCH (Generalized Autoregressive Conditional Heteroskedasticity). Numerous facets of Bitcoin have been studied, including as its financial properties, how it stacks up against conventional market ideas, whether it can be used as a hedge against risks or speculative bubbles, and how it relates to patterns in internet search terms. This research contributes to our understanding of Bitcoin's characteristics as a financial asset and its market behavior.

Globally, people utilize Bitcoin, a cryptocurrency, for investment as well as for digital payments. Bitcoin is owned by no one since it is decentralized. Since Bitcoin is not country-specific, transactions with it are straightforward. Even though they are not the same, Bitcoin values fluctuate much like stocks do. Several algorithms are applied to stock market data to predict prices. But there are distinct forces influencing Bitcoin. It is essential to predict the value of Bitcoin to make informed investing decisions. Unlike the stock market, commercial events or government interference have no effect on the price of Bitcoin. For this reason, we believe it is critical to predict the value of Bitcoin using machine learning technologies.

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Numerous investors, both individual and institutional, are drawn to the cryptocurrency market due to its remarkable growth and volatile price swings. Bitcoin is unique among these virtual currencies because of its extreme price volatility

and complex market dynamics. Because of this, estimating the price of Bitcoin is not only difficult but also quite significant. With Bitcoin's potential for huge profits drawing more and more attention, it is becoming more and more important to accurately predict its price changes to make wise investment decisions. Because of the unpredictability of the cryptocurrency market, having a solid forecasting model can be very helpful to investors in navigating this unstable environment. The primary objective of this work is to create and assess a machine learning model aimed at predicting Bitcoin values. We seek to determine how effective the Random Forest algorithm is at predicting changes in the price of Bitcoin. The findings will provide insightful information to investors who wish to use forecasting tools to make better choices in the volatile cryptocurrency market. As noted by Hellstrom and Holmstrom (1998) [8], predicting stock prices is a difficult task. Within academia, scholars are divided into two groups: those who think it is possible to create techniques for predicting market trends, and those who back Fama's efficient market theory (1970). This hypothesis contends that stock price movements are erratic and unpredictable, making precise forecasts all but impossible. Although the first cryptocurrency, called Bitcoin, was unveiled in 2009, the public didn't start to hear about it until around 2012.

Cryptocurrencies are essentially just strings of code with potential financial worth. These codes are produced by robust computers built to tackle challenging issues. Implementing a system that could evaluate data in real time and provide investors with guidance to aid in decision-making was the idea. The program will import data from the real world and undergo several data transformations to prepare it for feeding into machine learning techniques.

LITERATURE SURVEY

Devavrat Shah and Kang Zhang [1] investigate the use of Bayesian regression to forecast changes in the price of Bitcoin, a virtual currency that has seen a sharp increase in use recently. Using actual data and Bayesian inference, Bayesian regression enables the creation of more complex predictions by considering prior knowledge and uncertainty.

Huisu Jang and Jaewook Lee [2] examine how Bitcoin's time series data might be used to inform Bayesian Neural Networks' (BNNs) prediction of price variations. Additionally, the research focuses on identifying crucial Blockchain data points that have a major impact on the supply and demand of Bitcoin. The purpose of using these parameters to train models is to increase the forecast accuracy of Bitcoin prices.

Fagner Andrade de Oliveira and colleagues endeavored to forecast the closing price of PETR4 stock, which was traded on BM&FBOVESPA, using the application of artificial neural networks. Sample collection, data preparation, and prediction were the three stages of the study's design. The window size and prediction horizon were changed in 32 distinct combinations to investigate different forecasting scenarios.

Three Romanian equities are traded on the Bucharest Stock Exchange (BSE), and M. Daniela and A. Butoi [4] present a series of neural networks designed to estimate stock exchange rates for these stocks. They forecasted short-term price swings using a multistep-ahead technique. The results of this investigation may eventually be included into a sophisticated multi-agent system that uses data mining and data stream processing methods to help users make wise stock trading selections.

Siddhi Velankar et al. consider several variables that affect the value of Bitcoin to accurately forecast its pricing. We analyze daily patterns in the Bitcoin market and pinpoint the salient characteristics that are most important to change in the price of Bitcoin in the first phase of our research.

The overall findings [5] show that time series neural networks can be used for forecasting on the Romanian Stock Exchange; nonetheless, the best possible implementation strategy is needed. The process of buying and selling Bitcoins is simple. It is possible to purchase and sell Bitcoins online. It's a cozy spot to complete the business.

In this study [6], we attempt to predict the price of Bitcoin with a certain level of accuracy while taking into account a wide range of influencing factors. It uses the coin Markup cap to calculate the prediction. Quandl uses the MAT Lab characteristics to filter the dataset.

A variety of unique components are included in our work [7], including hourly prediction, using data from the previous day, window-based normalization, and comparing many model types with different number of layers.

The development of project-based learning in computer science engineering is the focus of this work [8], which takes into account the problem formulation, progression, student evaluation, and use of practical exercises based on the application of deep learning algorithms to create bitcoin price prediction applications.

Zheshi Chen et al. [9] investigate machine learning methods for forecasting Bitcoin values while taking feature dimensions and sample granularity into account. We show how important it is to include these aspects to improve prediction accuracy, in contrast to most previous studies that mainly concentrate on applying machine learning techniques.

PROPOSED SYSTEM

In this study, we attempt to accurately predict the price of Bitcoin while considering several variables that affect its worth. In the first phase of our study, we want to understand and identify daily fluctuations in the Bitcoin market as well as learn about the optimal conditions for its price. We have collected daily data for five years covering a wide range of Bitcoin pricing and payment network features. For the second part of our investigation, we will estimate the daily price change sign as accurately as possible using the data at our disposal. The architecture of the proposed system is shown in Figure 1.

Algorithm

Here, Random Forest is the algorithm in use. Machine learning's most well-liked and potent algorithm is called Random Forest.

- *Step 1:* Assume that the classifier contains M variables and N training samples.
- *Step 2:* Each node of the tree uses the number m as an input variable to determine the choice; m should be significantly less than M .
- *Step 3:* Select n times with replacement from among all N available training samples to consider the training set. By projecting their classes, use the remaining cases to estimate the tree's error.

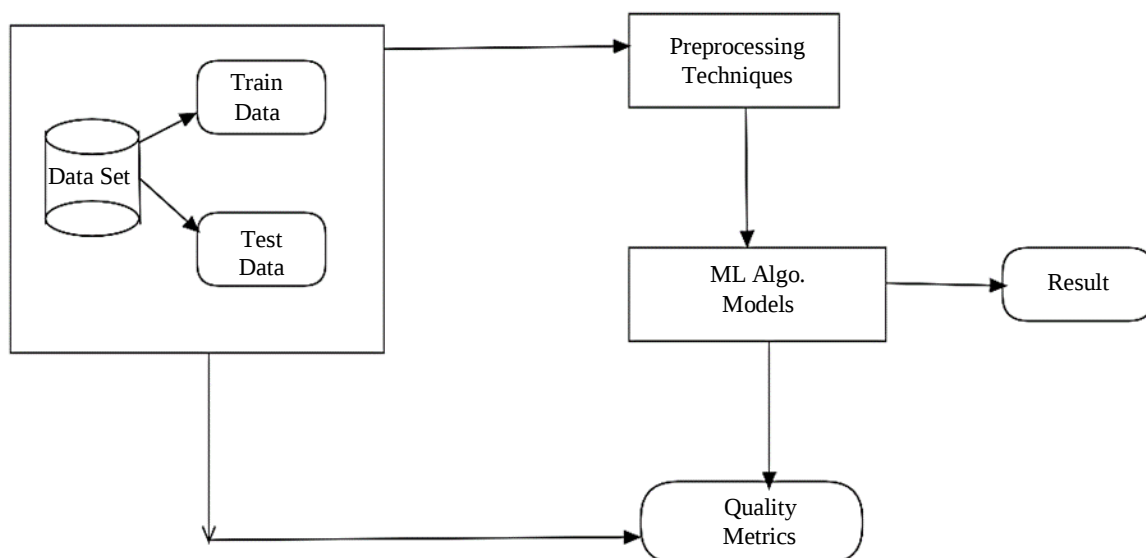


Figure 1. System Architecture of the proposed system.

- *Step 4:* For every node, choose m variables at random to use as a foundation for that node's selection. Based on these m factors in the training set, determine which split is the best.
- *Step 5:* Every tree is completely developed and has not been trimmed, unlike when building a typical tree classifier. A fresh sample is moved down the tree for predicting. When it reaches the terminal node, it is given the label of the training sample. The random forest prediction is the average vote of all the trees in the ensemble, and this process is repeated for each tree in the ensemble. similar to the classifier receiving the most votes.

RESULT AND DISCUSSION

Different colors of lines represent results predicted by different algorithms and red lines represent actual values or original values.

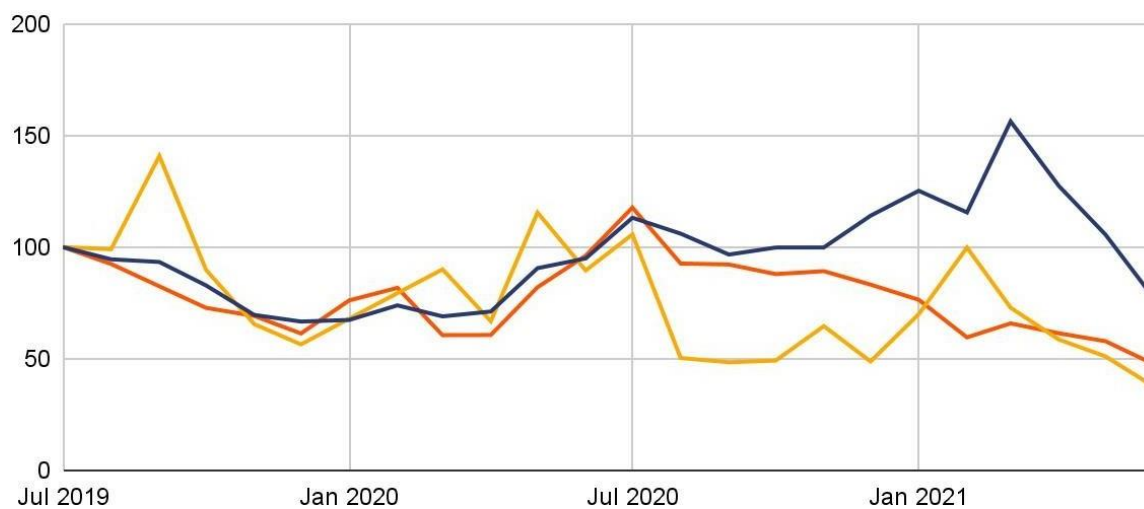


Figure 2. Prediction Graph.

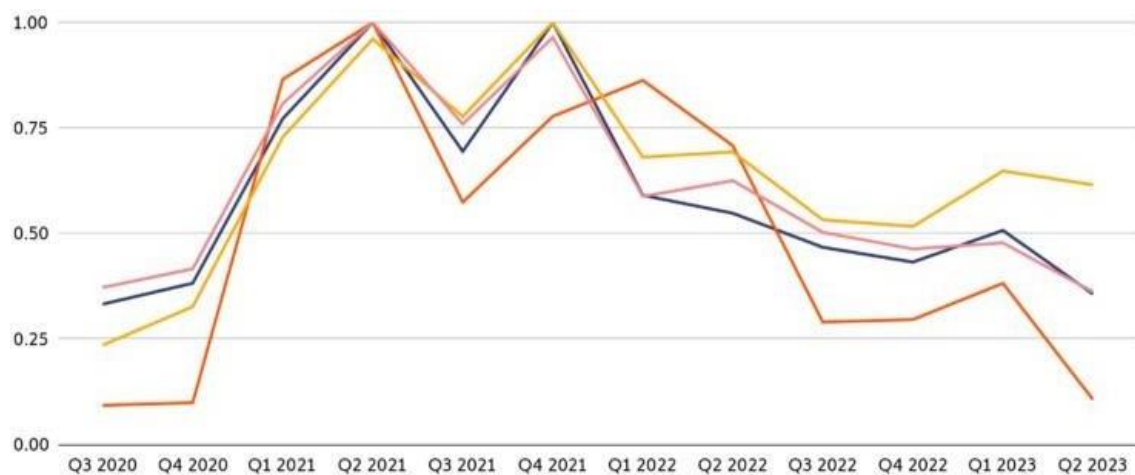


Figure 3. Prediction Graph.

CONCLUSION

In this work, after building the learning framework and completing the normalization, we seek to apply the two methods, Bayesian Regression and GLM/Random Forest, and choose the most efficient approach to solve the Bitcoin prediction problem. We investigated the use of machine learning algorithms in this work to forecast cryptocurrency prices, a crucial and difficult endeavor given the volatility of cryptocurrency markets. Our findings show that, in comparison to more conventional approaches, machine learning models—especially those that make use of sophisticated algorithms and techniques—have the potential to yield insightful information and increase prediction accuracy.

Limitations and Challenges

Despite the encouraging outcomes, several obstacles still need to be overcome. The necessity for ongoing model modification and improvement is highlighted by the extreme volatility of cryptocurrency markets, problems with data quality, and the possibility of overfitting. Furthermore, outside variables like modifications to regulations and swings in market sentiment may influence how well the models work.

Future Research Directions

To improve prediction accuracy even more, future studies should integrate real-time data sources, work on making models more broadly applicable to a variety of cryptocurrencies and investigate hybrid models that incorporate many machine learning approaches. Furthermore, deeper insights into market dynamics may be obtained by combining varied and more detailed datasets, such as social media trends and news sentiment.

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