PRICE PREDICTION OF DIFFERENT CRYPTOCURRENCIES USING TECHNICAL TRADE INDICATORS AND MACHINE LEARNING

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PRICE PREDICTION OF DIFFERENT CRYPTOCURRENCIES USING TECHNICAL TRADE INDICATORS AND MACHINE LEARNING

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Abstract
From the past two years with increasing geopolitical and economic issues, global currency values have been falling and stock markets have been having a poor run & investors losing wealth. This has led to a renewal of interest in digital currencies. Cryptocurrency one of the most prominent digital currency has found itself in spotlight with investors wanting a piece of it and business establishments accepting it as a source of payment due to its stable performance in the last few years. This research has been done on predicting cryptocurrency prices using machine learning based neural network which has a lowest the model loss over 100 epochs during training and Technical Trade Indicators (TTI) graphs depicts a real BTC value 5 to 10 times in 300-days of current fiscal year has further supported this increasing trader confidence and a shift in global cryptocurrency graph by predicted BTC values. On the same lines, we are analyzing bitcoin prices using Machine Learning and Sentiment Analysis. We also study stock market trends in order to better predict bitcoin prices quantitively. In this work we analyze the impact of global currencies like US Dollar, foreign exchanges on Bitcoin prices and whether Bitcoin has the stability to dethrone global currencies and become the single medium of transaction. This work is adequate enough to aid in predicting price and with results obtained from predicting Bitcoin prices using machine learning based neural network achieving an accuracy of 94.89% under all circumstances of technical trade indication thereby bringing down its price prediction by over 13.7% in April 2020 itself during evaluation.

Keywords: Cryptocurrency, technical trade, machine learning, neural network, prediction, bitcoin, economics.

1. Introduction

The aim of this research is to examine whether the price of Bitcoin can be predicted similar to other stock market tickers. This will have a basis on whether we can further use it as a medium of payment. In order to arrive at this, we will look at factors such as if bitcoin can be used as an investment as described in [1]. This will help in providing support to our objectives. We will also analyze how sentiments affects bitcoin and whether it is similar to the manner in which stock markets are influenced by sentiments. This will lead to drawing similarities and differences between how bitcoin and stocks perform. In-order to ensure that cryptocurrency is not spent recklessly or to further keep security and practicality of cryptocurrency, a central ledger was planned and built that would keep track of all transactions taking place. The unique aspect of this ledger is that it is controlled by all the users who own bitcoins and not by a centralized entity such as banks or financial firms. This ledger was named 'Blockchain'. Blockchain keeps track of all Bitcoin transactions occurring anywhere in the world. It is a cryptographic implementation that provides the highest security towards ensuring that misuse or leak of Bitcoin data does not occur as described in [2]. It is implemented as a chain of blocks where each block contains the hash of the previous block. A network of nodes keeps the network up & running as well as maintains the cryptocurrency.

A key feature of implementing cryptocurrency for keeping a check on Bitcoin transactions was for avoiding double-spending as described in [3]. Double-spending can be explained as a drawback of digital cash systems where a digital coin or token can be spent more than once if the details of the digital coin or token are duplicated. This majorly affects currency values since devaluations of such currency takes place. Transactions in cryptocurrency are confirmed using Proof of Work concept as described in [4]. Proof of work makes use of hash functions, mathematical computations and solving a puzzle in order to ensure the legitimacy of bitcoin transactions. Proof of work makes use of Merkle Trees, which store the hash of each data block. This technique allows efficient and secure verification of each data block inside the blockchain. The computations however in proof of work require time and resources in terms of graphical processing units and continuous power supply.

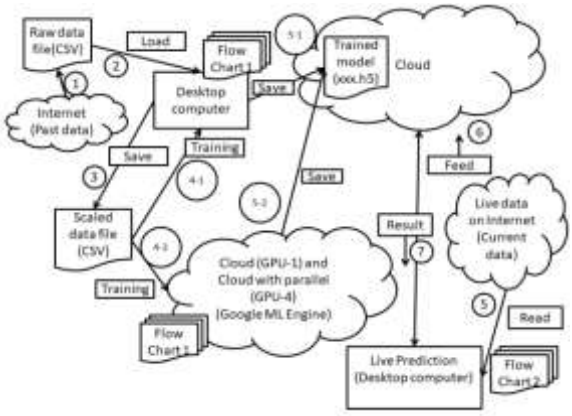


Figure 1: A cloud-based lice price prediction mechanism on desktop computer [5].

The advantage of using a proof of work algorithm is to ensure that the network is safe from Denial of Service attacks which have become rampant nowadays. This is because such an attack would require a huge amount of time and computation cost in order to be successful and even though bitcoin exchanges and wallets have been hacked due to poor security protocols, bitcoins stolen haven't been able to be cracked and used because of this important feature. As we talk about cryptocurrency and proof of work for ensuring security of Bitcoins, it is a matter of interest to further talk about how bitcoins are generated. The process of obtaining bitcoins is called as Mining. In simple term, bitcoins are awarded when miners are able to solve some puzzles which require heavy computations that take days or months even. Once they have solved the puzzle, a new block is formed andthe transactions are confirmed. On successful confirmation, the miners are awarded bitcoins based on their work. Cryptocurrency mining has been rampant in countries like Russia and America where old warehouses and industry units have been converted into mining farms. These farms have been setup with hundreds of CPU's and GPU's that work consume huge amounts of electricity and work 24 hours a day 7 days a week in order to mine bitcoins. This clearly shows the huge amount of investment that needs to be made for a return which could be a petty amount or turn the investor a millionaire by stroke of luck as described in [6].

1.1 Problem Statement

Unlike traditional paper currency which can be printed as per market needs, Cryptocurrency has a limited supply. This is in order to ensure that printer inflation does not occur and the currency does not get devalued. However, due to the limited supply of cryptocurrency and with 80% cryptocurrencies already mined by mid-July 2018, it is anticipated that the remaining of the 21 million worth of cryptocurrencies will take a large amount of time to mine and in order to perform such large computations, relative infrastructure will also be required with the possibility of a low return in the future. The price controlling is quite challenging task in the domain of cryptocurrency. With a general acceptance and price prediction of cryptocurrency since the last few years, other cryptocurrencies or digital currencies as we call them have also come to reality and become mainstream for price prediction. We will use Machine Learning and Technical Trend Indicator for the controlling the price hike in the cryptocurrency. Bitcoin and Ethereum are two of the most commonly known cryptocurrencies which have been used for developing different applications and further researched by banking firms for implementation.

1.2. Aim of Study

The core idea behind this research is to design and integrate the price prediction of different cryptocurrencies using technical trade indicators and machine learning which is an automated mechanism of controlling the price of currency.

- Is it possible to have Bitcoin as a publicly traded commodity with price prediction? The results for the objective can be then applied to findings of the following objectives:
- Can cryptocurrency be used as any other traditional currency like US Dollar for controlling the price.
- Does cryptocurrency like Bitcoins have the ability to become a primary method of transaction, replacing US Dollar and other traditional currencies with weekly price prediction.
- Developing an automated application for predicting a price hike in cryptocurrency with respect to different time series using machine learning and technical trend indicator.

2. BACKGROUND

A company's financial evaluation is done on the basis of certain fundamentals which are qualitative and quantitative data. These factors are examined by Analysts and Traders in order to estimate whether an asset, company are performing well and whether investment can be made in it as described in [7]. Apart from these technical indicators, traders also rely on market sentiments or investor sentiments. These are sentiments that influence technical indicators as well since they can be used to make a profit by predicting short term price movements. Although these predictions are irrational investment decisions but since they yield a result, we can say that the decision was driven by sentiment rather than by facts.

This paper [8] guides home the point that the basis of an outcome of an important democratic activity like elections can have a huge bearing on the performance of stock markets. We have all seen several instances of this such as the stock markets rallying in green when a market friendly government is elected. Author in [9] has provided a report speculating the impact of recently held Midterm Elections in November 2018 on U.S stock markets. The report covers excerpts from different banking directors and a thorough analysis of historical performances of stocks during election times which were directly impacted by the outcomes of the elections. However, a speculation is also drawn which tries to dispel these assumptions in light of the fact that stocks tend to sway more not due to the results of the winners which might have a little say but also due to the implications that arise from different policy decisions that are waiting to be implemented and might not be now due to a change in government rhetoric after election outcomes.

Figure 2: The up to date global foreign exchange reserves by normal currency transaction [10].

This has had a spiraling effect on economies of countries like Turkey, Argentina who have being seeing their currency devalued with every passing day. Other countries such as China have been struggling hard to ensure that

Chinese yuan is still comparable to global currencies due to the ongoing trade wars. In order to do this, they have been devaluing their currency, but it has had a serious impact on countries that borrow from China as described in [11].

The figure 2 above depicts the percentage distribution of different currencies globally. We can clearly see that US Dollar leads with 90% presence in the markets followed by 31% presence of Euro and other global currencies as described in [12]. It wouldn't be right to say that dollar has a monopoly over world trade and any changes that affect the dollar have a cascading effect on other commodities too. However, this has been the way things were set up by the erstwhile governments. Its solely the author's view that there needs to be a new global currency which is immune from the impacts that a single currency causes globally. This global currency has its advantages in terms of not affecting developing countries economy such as Argentina's pesos and Turkey's lira which are running in the upgrade flow due to dollar becoming stronger of late as described in [13]. The volatility in the price of Cryptocurrency generated a lot of attention in the latter half of 2017 when the price of cryptocurrency was steadily rising and at one point one can say it was a steep rise as well. This rise not only attracted the attention of the general public which saw it as a way to increase their fortunes but also brought the focus of many hedge funds, banking corporations and even Wall Street and other world stock exchanges to it. Chicago Exchange Board did an in-depth study and introduced Cryptocurrency Futures trading with an eye to the future and to attract investors. The media also has carried stories of different individuals becoming overnight millionaires due to the rapid increase in cryptocurrency value. Banking corporation CEO's have been speculating a lot on whether to open cryptocurrency trading desks and support operations or not. Businesses have sprung up which solely use cryptocurrency for transactions such Ethereum, a California based Real Estate agency that uses Cryptocurrency and other cryptocurrency for real estate transactions and is quite active on Twitter as described in [14].

With all the attention on cryptocurrency, it seems quite an innovative idea to invest in Cryptocurrency and earn a fortune on your investment. However, before taking a step towards deciding and investing, let us first analyze the feasibility of investing in Cryptocurrency compared to investing in other stable stocks as from the above sections we do note that Cryptocurrency prices are volatile. This volatility is due to many factors. The primary of all these factors is the attention it is getting from individuals. We call this as the sentiment people have towards cryptocurrency.

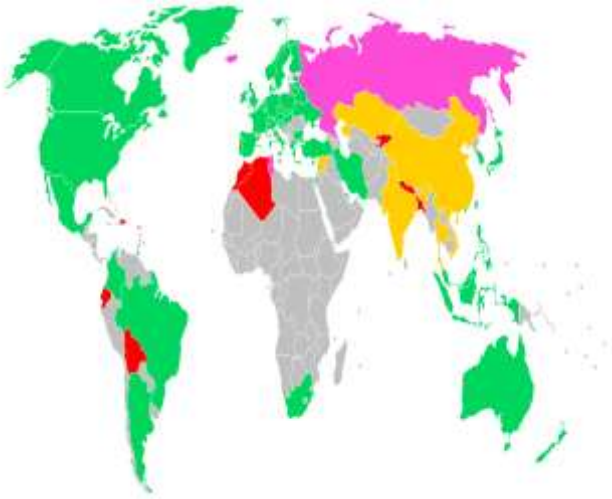


Figure 3: The legality of cryptocurrency around the globe mapped over world map [15].

Bitcoin is based on blockchain technology, a secure platform which is being adopted in developing products by major banks worldwide as well as by companies in medical domain in order to provide clients with greater security for their data. In this manner, investment can be made in blockchain so as to not get tangled with Bitcoin and its associated volatility. Organizations such as IBM, Nvidia, Microsoft have been adopting blockchain technologies to fit in with their client demands. Another manner of indirectly investing in Bitcoin is by mining Bitcoins. Companies like Nvidia develop processors that can perform complex computations as required by algorithms designed to produce bitcoins. It should be noted here though that mining bitcoins is a complex task in itself since it consumes a lot of electricity, time and resources in order to mine a single bitcoin.

3. METHODOLOGY

Bitcoin price data (BTC-USD) was initially collected from Kaggle [16]. The data collected was cross-checked with that from Coinbase in order to avoid any unwanted discrepancies. Data collection in the beginning stage was manual since Kaggle deprecated their API Library which was earlier used on Python to seamlessly fetch data and save it directly by making an API call to the website. However, in due course it was realized that the existing data had values which even though were compensated for, still affected the prediction and thereby produced wrong results. Hence, a shift was made to using REST API's which proved to be significant since the results now obtained were more accurate and meaningful.

We used an API's to fetch this Kaggle Bitcoin Historical dataset. The obtained dataset was then averaged into one dataset for consistency and in order to fill in the gaps created by missing data in dataset. This obtained data was provided to Keras for prediction purposes.

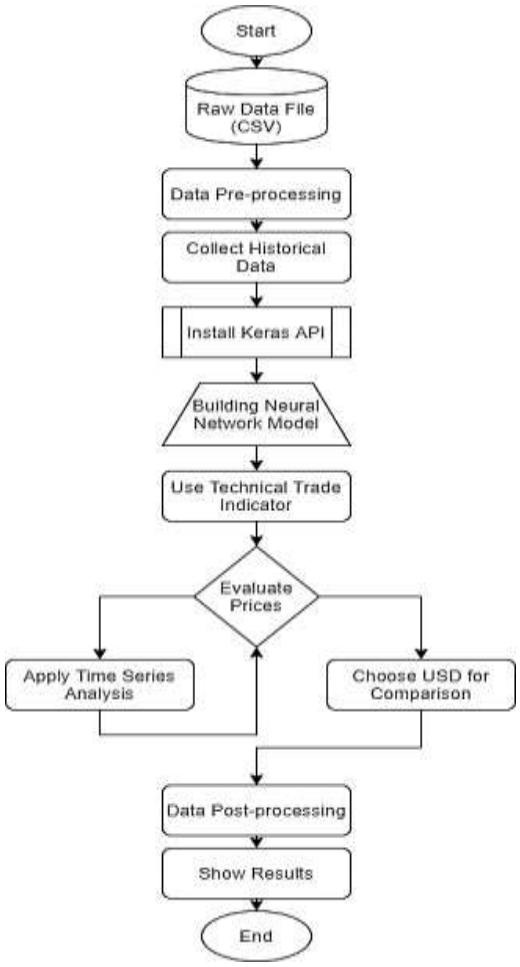


Figure 4: Flow diagram of approach being followed.

3.1. Building Neural Network Model

Machine Learning is the most suitable technique which can be used here to predict Bitcoin cryptocurrency prices prediction. The model to be built had to achieve several goals in order to produce a near to accurate prediction. This included selecting the framework which could produce a good prediction accuracy, take in consideration of other parameters in its prediction algorithm and be trainable. Keeping these goals in mind, several different frameworks were tested and the author finally landed on using Keras, which is a neural networks API running on top of Tensorflow. Keras was compared against Support Vector Machine. In comparison to SVM, Keras is less expensive in performance and computation. When we discuss about machine learning frameworks, depending on how we would want the learning to be, we can decide over the frameworks that can be used.

Next, there was the need to decide which layers had to be included and how many of them will be required along with deciding the epoch rates. The dataset used for training was standardized and transformed since this is more suitable for many activation functions.

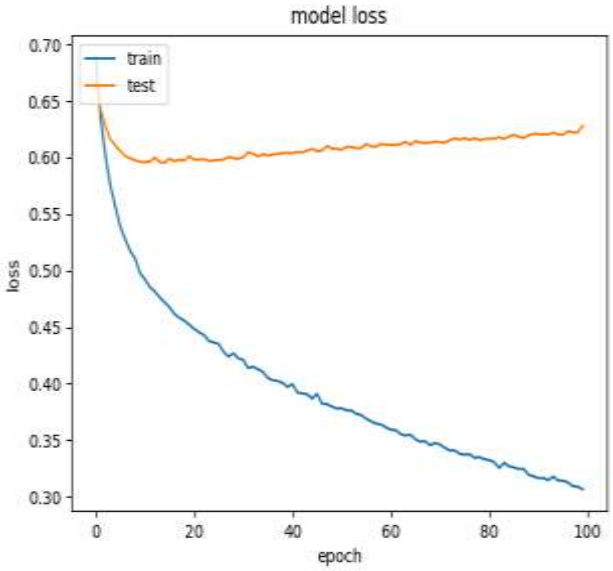


Figure 5: The diagram explaining the model loss over 100 epochs of training.

3.2. Technical Trade Indicator

Sentiment is commonly defined as a reaction to an event or thing. Every living organism expresses sentiments in one way or another. Human beings display reactions or sentiments in multiple ways such as facial expressions, change in tone, physical actions. This expression of sentiment is being used since a long time on different domains most common among them being products analysis and demand. Producers can tap into sentiments of the people to find out more about how their products are perceived and changes that could be made to make them more successful.

In a similar way, sentiment can be gauged as to how people react when there are tax cuts, changes in prices, stock prices changing. This sentiment can be analyzed to forecast or predict stock prices since if there is good news about a company performing well, people will be interested in buying stocks of that company or be a part of it so as to achieve success in the future. Similarly, in the event of a failure, people dis-associate themselves from poor performing companies. The decision to use sentiment analysis was majorly to follow in the footsteps of existing works that had used sentiment analysis on twitter data with the help of different machine learning frameworks to analyze the sentiment of the data and build conclusions on it. We will be covering multiple phases of using sentiment analysis apart from obtaining tweets from twitter and web scrapping data. We would be looking at how people perceive changes in government policies, economic changes, geopolitical factors to name a few.

3.3. Price Mining API

Python Web Scraping or data scraping from web or price mining is a technique used for extracting data from websites using either web crawlers built personally or by web crawling service providers or by means of API's provided by websites. Some notable services providing web-scraping tools are Amazon, Google, Webhose.io etc.

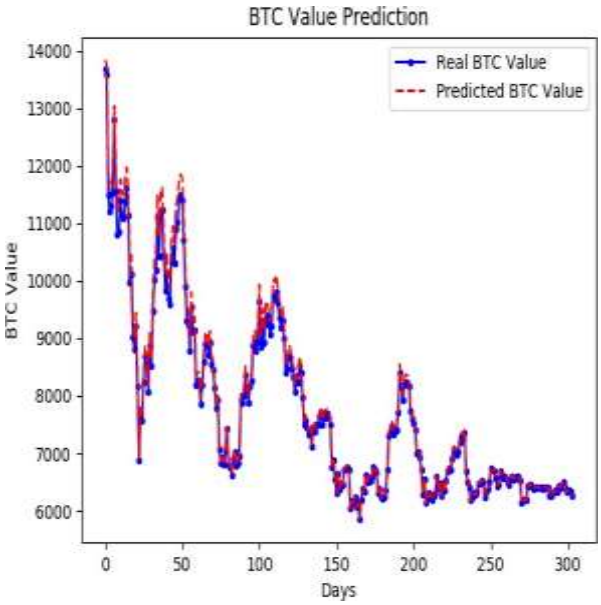
Apart from fetching and classifying tweets obtained from Twitter API, the author realized a need to obtain data from sources other than twitter in order to improve the prediction algorithm and delve more deeper into finding the reasons for bitcoin's volatile price. For this purpose, it was decided to web scrape data from news articles which would serve as additional support apart from twitter obtained data. This web scraping of data was performed by writing code in Python and automating the feature of reading price from websites and running prediction algorithms on them.

3.4. Price Sentiment Data

Price sentiment is commonly defined as a reaction to an event or thing. Every living organism expresses sentiments in one way or another. Human beings display reactions or sentiments in multiple ways such as facial expressions, change in tone, physical actions. This expression of sentiment is being used since a long time on different domains most common among them being products analysis and demand. Producers can tap into sentiments of the people to find out more about how their products are perceived and changes that could be made to make them more successful. In a similar way, sentiment can be gauged as to how people react when there are tax cuts, changes in prices, stock prices changing. This sentiment can be analyzed to forecast or predict stock prices since if there is good news about a company performing well, people will be interested in buying stocks of that company or be a part of it so as to achieve success in the future. Similarly, in the event of a failure, people dis-associate themselves from poor performing companies. The decision to use sentiment analysis was majorly to follow in the footsteps of existing works that had used sentiment analysis on twitter data with the help of different machine learning frameworks to analyze the sentiment of the data and build conclusions on it.

4. RESULTS

We have achieved a near to accurate price prediction using our neural network algorithms which can be helpful in deciding whether to buy cryptocurrencies or not. From the graph, we can observe the volatility of Bitcoin prices in the last 1 month of April itself since the sample testing space for this research. As discussed above, this volatility in cryptocurrency prices has been due to several factors. We can attribute this fall of Bitcoin price due to the technical trade indicators which have been positive towards cryptocurrency due to governments readily accepting it. This coupled with stronger global currency indices may have been a reason in its fall. There are no specific reasons or events that point to the cause in the fall of cryptocurrency unlike for stock markets, where a reason for the meltdown in a company's stock can be pinpointed to some frantic event. One reason attributed here is price correction of



cryptocurrency and other digital currencies which have brought down the exchange price by 5 to 10 time as predicted by the technical trade indication graphs below.

Figure 6: The technical trade indicator graph of real BTC value 5 times in 300-days of current fiscal year has further supported this increasing trader confidence and a shift in global cryptocurrency graph by predicted BTC values.

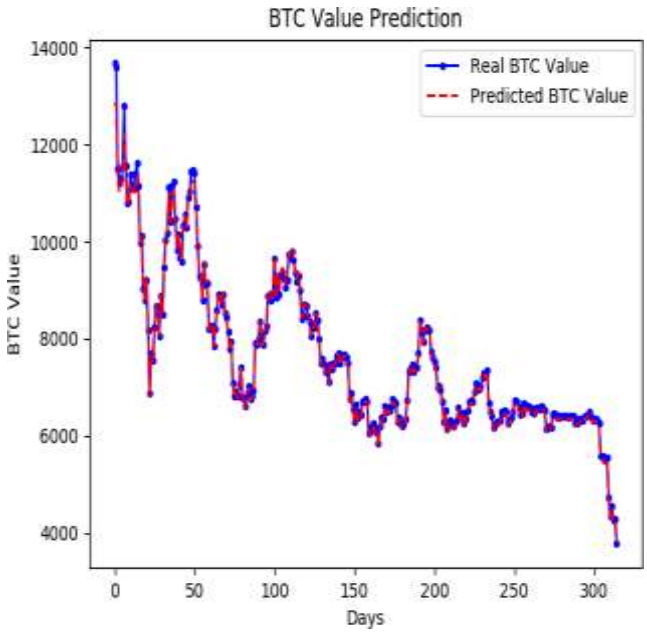


Figure 7: The technical trade indicator graph of real BTC value 10 times in 300-days of current fiscal year has further supported this increasing trader confidence and a shift in global cryptocurrency graph by predicted BTC values.

There were discrepancies in the prediction of public sentiment due to the fact that given the volatility of Cryptocurrency Prices, public reaction was not quick and adequate enough to aid in predicting price and correlating the results with results obtained from predicting bitcoin prices using machine learning based neural network achieving an accuracy of 94.89% under all circumstances of trade indication.

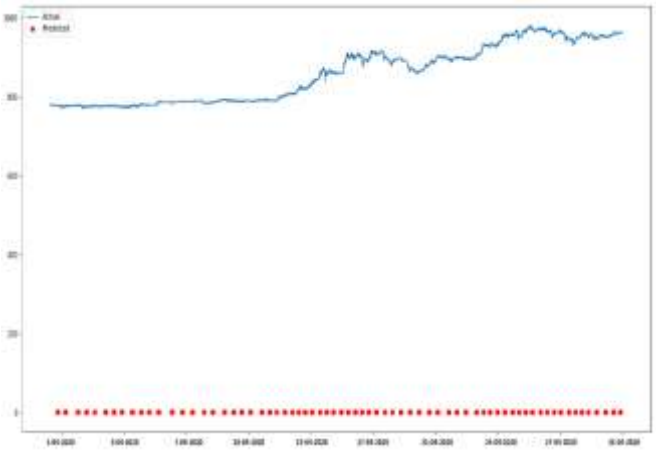


Figure 8: The prediction of actual bitcoin-based cryptocurrency price in comparison with the predicted price by the neural network model and trade indicator before initialization.

Figure 9: The prediction of actual bitcoin-based cryptocurrency price in comparison with the predicted price by the neural network model and trade indicator after initialization.

The figure above depicts results obtained from a sample set of python-based web scrapped data for technical trade indicator graphs. This python-based web scrapped data consisted of news data available on cryptocurrencies from famous and widely read sources. It is being speculated that even for cryptocurrency, there must have been traders who might have bet on the fall of bitcoin after its introduction in the futures market. Negative speculation is a common feature observed in stock markets.

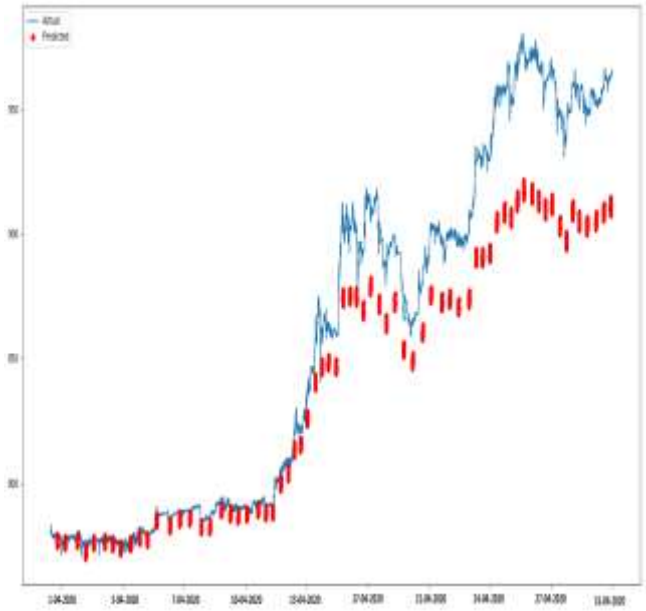


Figure 10: The prediction of actual bitcoin-based cryptocurrency price in comparison with the predicted price by the neural network model and trade indicator predicting all the price hikes in a month.

5. DISCUSSION

Countries like Russia, China, America have been seriously upbringing on cryptocurrency mining centers and cryptocurrency exchanges banning the mining of bitcoins and any transactions involving them. Turkish Government has gone an extra mile by raiding financial institutions and exchanges dealing with cryptocurrency. This has set a massive positive and fearful sentiment among investors which can be attributed to the cause of cryptocurrency

selling, thereby bringing down its price by over 13.7% in April itself. Governments have been leading the upgradation on cryptocurrency mining, exchanges, declaring them not legal in order to reserve their state currencies from getting affected. For instance, China's major bank People's Bank of China (PBOC) has been saying that bitcoin cannot be trusted since it's difficult to control a risky financial speculation, but maybe protecting yuan plays an important role. The increase in federal interest rates (2%) by the Federal Reserve Board not only affects US Markets, but worldwide markets as well. For example, when the Federal reserve board increased the federal interest rates, it sent ripples through all major stock markets affecting the values of Nikkei, Sensex, Euro, GBP. Traders in these markets namely Japan Stock Exchange. Bombay Stock Exchange, London Stock Exchange started buying dollars which also affected the exchange rates. Now, when this happens naturally the leading banks of the respective countries have to step in to control any fall in their country's currency exchange value.

This change in federal interest rates can be seen impacting the prices of cryptocurrency. This is because investors purchase by exchanging one form of currency for 1 Bitcoin and there is a certain exchange rate setup. Now, when interest rates are increasing, people will naturally invest and buy USD since it's showing signs of stability and yield and not buy cryptocurrency which has been severely volatile for the last several weeks.

6. CONCLUSION

In this proposed research, we have designed a price prediction system of different cryptocurrencies using technical trade indicators and machine learning achieving an accuracy of 94.89% under all circumstances of technical trade indication thereby bringing down its price prediction by over 13.7% in April 2020 itself during evaluation. For any new product to become global, it needs to be accepted by people and business firms alike. When we look at advance methods of machine learning for the transactions of paper-based currencies (such as US Dollar currency) to cryptocurrency for that matter on which the global world depends, we observe that it has been accepted and implemented at the root level. We used a python language based fully automated machine learning and technical trade indicator for the prediction of price. For countries where people have access to such technology there is a high possibility that bitcoin transactions can be adopted over traditional currency. However, in countries still developing and where people do not access to technology, this would prove to be a disaster. The prediction of actual bitcoin-based cryptocurrency price in comparison with the predicted price by the neural network model and trade indicator before initialization, after initialization and gave the prediction in price hike for whole month.

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