Artificial Intelligence-Based Analysis of Cryptocurrency Prices

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ABSTRACT: Due to its increasing popularity and acceptance among merchants, cryptocurrency is becoming more and more significant in the effort to change the financial system. Even though a lot of individuals are investing in cryptocurrencies, the dynamic characteristics, unpredictability, and predictability of cryptocurrencies are still largely unknown, dramatically increasing the danger of the investments. It is important to make an effort to comprehend the variables that affect the construction of values. In this study, we investigate the price dynamics of Bitcoin, Etherum, and Ripple using advanced artificial intelligence frameworks of fully linked Artificial Neural Network (ANN) and Long Short-Term Memory (LSTM) Recurrent Neural Network. We discover that LSTM is more effective at utilising useful information than ANN, which primarily relies on long-term history and short-term dynamics.

Keywords- ANN; LSTM; Recurrent Neural Network

1. Introduction

The peer-to-peer electronic money and payment system known as cryptocurrency operates online and is regulated by an algorithm. When a miner successfully decodes an algorithm to add a block of transactions to the blockchain, a public ledger, and the cryptocurrency are formed. Through a decentralized network and encryption protocol, it enables people to store and transport information [1]. The cryptocurrency system's competitive and essential component is mining. The likelihood of discovering a new coin is higher for the miner with greater processing power than for the miner with less[2]. The first and most popular digital currency was established by Satoshi Nakamoto in 2008 and is known as Bitcoin (whose market capitalization was over $7 billion in 2014 and climbed dramatically to $29 billion in 2017) [3][4]. The most amazing characteristic of bitcoin is its decentralization, which completely eliminates the influence of traditional financial sectors and monetary authorities thanks to its blockchain network features [4]. Additionally, because the transaction history of the Bitcoin electronic payment system cannot be changed without re-doing all of the blockchain's proof of work, which serves as a crucial role as a trust intermediary and is widely applicable in reality, the system is based on cryptographic proof rather than mutual trust. Additionally, the blockchain's controllable anonymity scheme introduced by bitcoin improves user safety and anonymity. For example, we can use this feature of the blockchain to create identification cards that not only protect our privacy but also authenticate our identity. Nowadays, one of the most

effective means of making money is by investing in cryptocurrencies like Bitcoin. For instance, the price of Bitcoin increased significantly in 2017, rising from a relatively low position of 963 USD on January 1st to its top of 19186 USD on December 17th, and closing the year with 9475 USD [5]. Since the rate of return on bitcoin investments was over 880% in 2017, this is an impressive and unexpected development for investors[5]. Although market forecasting is difficult due to its complexity, its dynamics are somewhat predictable and comprehensible. For instance, when there is a shortage of bitcoin, its sellers will raise the price because buyers who see bitcoin as a lucrative investment opportunity will be eager to pay more for it. Furthermore, some powerful external influences, like as political issues, may have a significant impact on the price of bitcoin. A few studies have been working to comprehend the cryptocurrency time series and develop statistical models to replicate and predict price movements, despite the fact that there are currently little efforts on cryptocurrency analysis and prediction. For instance, Madan et al. integrated the blockchain network—the technology that underpins bitcoin—with the price of bitcoin across intervals of 0.5, 1 and 2 hours. [1]Their predictive algorithm makes use of random forests and binomial logistic regression classifiers, and its accuracy in foretelling the price of bitcoin is roughly 55%. Shah et al. applied Bayesian regression and benefited from high frequency (10-second) Bitcoin[8][9] price data to enhance bitcoin investment strategy. Their models have enjoyed enormous success as well. The opening, minimum, maximum, and closing prices were used as inputs in [5], a Multi-Layer Perceptron (MLP) based prediction model to forecast the price of bitcoin for the following day. Moving averages were used as inputs for both short (5,10,20 days) and long (100,200 days) windows. Their model's accuracy was found to be 95% during validation. There have been numerous academic studies on forecasting exchange rates, such as Meese and Rogoff's (1983, 1988) examination of the monetary and portfolio balance models. While significant attempts have been made to evaluate and forecast the patterns of conventional financial markets, particularly the stock market[10], it is still early to predict the prices of the cryptocurrency markets. Traditional time series approaches are not as effective as these stock price prediction models since cryptocurrencies are not exactly the same as stocks but can be seen as an addition to the current monetary system with characteristics of sharp fluctuations. Therefore, it is crucial to create a proper predictive modelling framework and better comprehend the dynamics of cryptocurrencies. In this study, we hypothesis that cryptocurrency time series show a clear internal memory, which might be leveraged to improve the performance of the memory-based time series model provided the internal memory length could be measured. To comprehend and forecast the price dynamics of the most well-known cryptocurrencies, such as Bitcoin, Ethereum, and Ripple, we plan to apply two artificial intelligence modelling frameworks.

2. Literature Review

Using the bitcoin transaction graph to predict the price of bitcoin. The most popular cryptocurrency in the world, Bitcoin enables users to transact safely and discreetly over the Internet. Consumers, corporations, investors, and speculators have all recently been interested in the Bitcoin ecosystem. While a lot of study has been done to examine the architecture of the Bitcoin network, less has been done to examine how the network affects the price of Bitcoin as a whole. In this study, we look into the ability of blockchain network-based features to

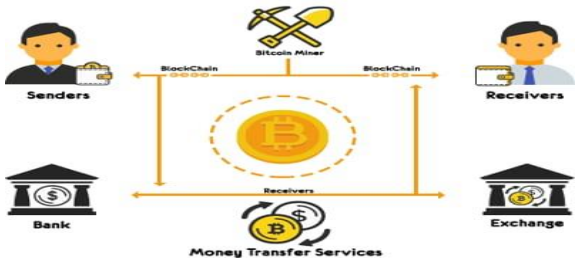
forecast changes in Bitcoin price. With the help of machine learning optimisation and blockchain-network-based feature engineering, we achieve an up-down Bitcoin price movement categorization accuracy of about 55%.[1] Greaves, A., & Au, B. (2015).

“Cryptocurrency value formation: An empirical study leading to a cost of production model for valuing bitcoin.” This study uses cross-sectional empirical data to look at 66 of the most popular 'coins' to determine the most likely source(s) of value that cryptocurrencies display on the market. The difficulty of "mining" for coins, the pace of unit creation, and the cryptographic technique used are the three key factors identified by the regression model that was developed. If all else is equal, this translate into marginal variances in the cost of producing each coin. Relative prices in bitcoin were employed, which significantly reduced price fluctuation caused by the dollar exchange rate. The generated regression model can be utilized to comprehend the factors that influence relative value as it is seen in the developing cryptocurrency market. A cost of production model is suggested for pricing bitcoin using the aforementioned research, with electricity serving as the main input. By establishing breakeven thresholds to begin and end production, this theoretical model yields valuable conclusions for the macro-exchange rate of bitcoin as well as for a single producer. In principle, miners will continue to create until their marginal costs are equal to their marginal products, making bitcoin production resemble a competitive commodity market. [2] Hayes, A. S. (2017).

“Economic prediction using neural networks: the case of IBM daily stock returns”. A report on some of the findings from an ongoing study that looks for and decodes nonlinear regularities in asset price movements using neural network modelling and learning approaches is provided. The case of IBM common stock daily returns is the author's main focus. Dealing with the key characteristics of economic data shows the importance of statistical inference and necessitates changes to conventional learning methods that might be beneficial in other situations. [9] H. White

Kaastra and M. Boyd’s study report on “Designing a neural network for forecasting financial and economic time series”. Artificial neural networks are extremely adaptable, universal function approximators that were initially developed in the engineering and cognitive science sectors. The use of neural networks in finance for tasks including pattern recognition, classification, and time series forecasting has significantly increased in recent years. However, the design process still involves a lot of trial and error because to the enormous number of parameters that must be chosen to create a neural network forecasting model. In order to forecast economic time series data, this paper aims to provide a useful, basic introduction to neural network design. An eight-step process for creating a neural network forecasting model is described, along with tradeoffs in parameter selection, some typical mistakes, and areas of practitioner dispute. [10]

3. System Architecture



Blockchain: Cryptocurrencies use a decentralized, distributed ledger called a blockchain to record all transactions and maintain a transparent transaction history. The blockchain consists of a chain of blocks, where each block contains a set of transactions that are cryptographically linked to the previous block.

Cryptography: Cryptography plays a crucial role in ensuring the security and integrity of the cryptocurrency system. It is used for secure transaction verification, wallet encryption, and the generation of digital signatures to prove ownership and authenticity.

Peer-to-Peer Network: Cryptocurrencies often rely on a peer-to-peer (P2P) network of nodes that communicate with each other to maintain a consensus on the state of the blockchain. Nodes participate in the network by validating and propagating transactions, verifying blocks, and broadcasting updates to other nodes.

Wallets: Cryptocurrency wallets are software or hardware-based applications that allow users to securely store and manage their digital assets. Wallets store the user's private keys, which are used to sign transactions and access their funds. Wallets can be either hot wallets (connected to the internet) or cold wallets (offline storage) for enhanced security.

Mining: Many cryptocurrencies use a mining process to validate and add new transactions to the blockchain. Miners compete to solve complex mathematical puzzles, and the first miner to solve it gets the opportunity to add a new block to the blockchain. This process ensures the security and immutability of the blockchain.

It's important to note that the specific architecture of a cryptocurrency can vary depending on the underlying technology and design choices made by the development team. Different cryptocurrencies may have unique features and components beyond the ones mentioned here.

4. IMPLEMENTATION

Fig 1: The Main Home Page.

User

User information registration: The user activated the next administrator. login on the user page. User views a few fields, including "start trading," "bit bucket, “forecast", "logout”. Now that the trading page is online, users can purchase cryptocurrencies that are for sale. User views the prediction for the datasets that are currently available as well as the transaction history details.

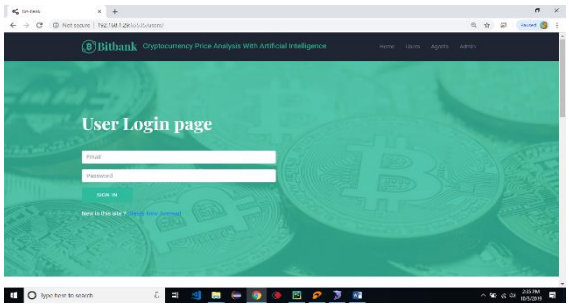


Fig 2: User Login Page

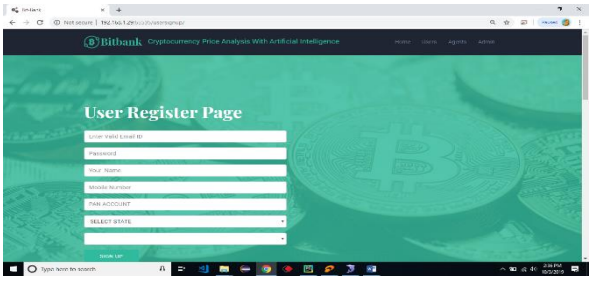


Fig 3: Registration Page display when a user is registering for the account

Agent

First agent page registration, the administrator then turns on Agent login page. Agent views a few fields, including "buy," "bitbucket," "block bucket," and "prediction." There are three different types of digital currency available here: Bitcoin, Ripple, and Ethereum. An agent may purchase any, all, or all three digital currencies. Agent purchasing digital currency. Also included is the history of agent transactions.

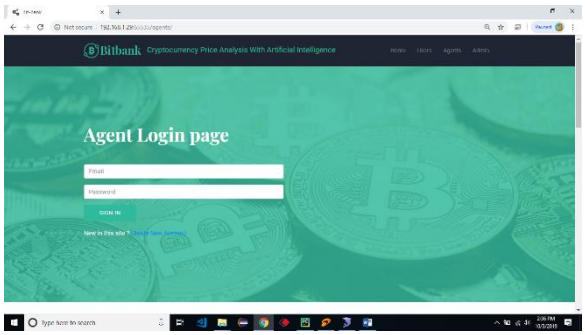


Fig 4: Login Page display when Agent uses the system.

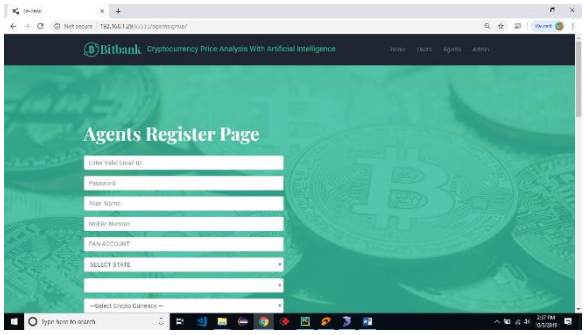


Fig 5: When an Agent wants to register for the account, they go through the Agent Registration page.

Admin

Admin's goal is to authorize users and agents. Some fields in admin are [user, agents, crypto, bit block]. Admin can check user and agent registration information, and under the cryptocurrency field, users can adjust the exchange rate and view a list of recent changes to the cryptocurrency. admin view the specifics of the current transaction. When a miner successfully decodes an algorithm to add a block of transactions to the blockchain, a public ledger, and the cryptocurrency are formed. Through a decentralized network and encryption protocol, it enables people to store and transport information. The cryptocurrency system's competitive and essential component is mining. The likelihood of discovering a new coin is higher for the miner with greater processing power than for the miner with less. The first and most popular digital currency was established by Satoshi Nakamoto in 2008 and is known as Bitcoin (whose market capitalization was over $7 billion in 2014 and climbed dramatically to $29 billion in 2017). The most amazing characteristic of bitcoin is its decentralization, which completely eliminates the influence of traditional financial sectors and monetary authorities thanks to its blockchain network features.

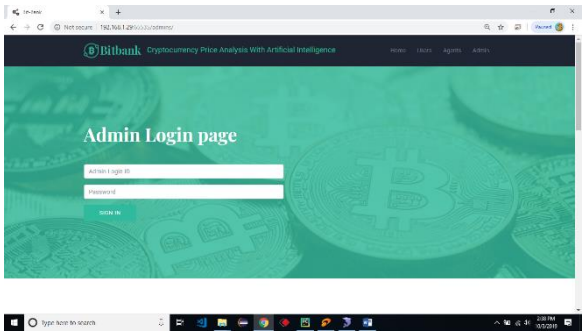


Fig 6: Admin login page

5.Conclusion & Future Enhancement

Bitcoin and other cryptocurrencies have established themselves as playing a key role in decentralization. After Bitcoin, many other cryptocurrencies emerged, including Ethereum and Ripple. Many people use them as a kind of speculation due to the high level of price uncertainty. Understanding the internal characteristics and predictability of various cryptocurrencies is so crucial. In this study, we investigate and forecast the price dynamics of

Bitcoin, Etherum, and Ripple using two different artificial intelligence frameworks, namely fully-connected Artificial Neural Network (ANN) and Long-Short-Term Memory (LSTM). We demonstrated that, while having various internal structural differences, the ANN and LSTM models are equivalent and both perform adequately in price prediction. The impact of historical memory on model prediction is then further examined. We discover that LSTM tends to rely more on short-term dynamics whereas ANN tends to rely more on long-term history, which suggests that LSTM is more effective than ANN at using hidden knowledge from the past. In contrast to LSTM, ANN may attain a similar level of accuracy given enough historical data. This study offers a distinctive proof of the predictability of the cryptocurrency market price. Nevertheless, the explanation for the predictability may change depending on the type of machine-learning model used.

Enhanced Data Quality: The quality of the data used determines how accurate a bitcoin price analysis will be. Utilizing more dependable data sources, such as those that offer real-time price feeds from numerous exchanges, is one way to raise the quality of the data. In order to ensure that the analysis is founded on accurate and trustworthy data, AI algorithms can also be trained to recognize and rectify flaws in the data.

Integration of other Data Sources: To provide a more thorough analysis of bitcoin values, AI algorithms can be improved to combine other data sources, such as social media sentiment, news articles, and economic indicators. This might shed light on the variables influencing price changes and aid in forecasting future pricing trends.

Advanced Machine Learning Methods: To improve the precision of bitcoin price analysis, advanced machine learning methods including deep learning, neural networks, and reinforcement learning may be applied. These methods can be used to find patterns and trends in the data that human analysts might not see right away.

In conclusion, AI-based cryptocurrency price analysis has a bright future and may be improved in a variety of ways to increase precision and offer more thorough understanding of the cryptocurrency market.

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