

A Mechanism for Bitcoin Price Forecasting using Deep Learning

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Abstract—Researchers and investors have recently become interested in forecasting the cryptocurrency price forecasting but the most important currency can take that it's the bitcoin exchange rate. Some researchers have aimed at leveraging the technical and financial characteristics of Bitcoin to create predictive models, while others have utilized conventional statistical methods to explain these factors. This article explores the LSTM model for forecasting the value of bitcoins using historical bitcoin price series. Predict future bitcoin prices by developing the most accurate LSTM forecasting model, building an advanced LSTM forecasting model (LSTM-BTC), and comparing past bitcoin prices. This is the second step, if looking at the end of the model, it has very high accuracy in predicting future prices. The performance of the proposed model is evaluated using five different datasets with monthly, weekly, daily, hourly, and minute-by-minute bitcoin price data with total records from January 1, 2021, to March 31, 2022. The results confirm the better forecasting accuracy of the proposed model using LSTM-BTC. The analysis includes square error MSE, RMSE, MAPE, and MAE of bitcoin price forecasting. Compared to the conventional LSTM model, the suggested LSTM-BTC model performs better. The contribution made by this research is to present a new framework for predicting the price of Bitcoin that solves the issue of choosing and evaluating input variables in LSTM without making firm data assumptions. The outcomes demonstrate its potential use in applications for industry forecasting, including different cryptocurrencies, health data, and economic time.

Keywords—Currency; bitcoin; LSTM; forecasting; models

I. INTRODUCTION

Since cryptocurrencies are the newest financial innovation and are having a significant impact on the world economy, cryptocurrency price forecasts are very important. Fintech professionals and technologists are particularly interested in forecasting the price of cryptocurrencies and hosting blockchain conferences to educate the public on the most recent revolution. Previous studies have observed proof of this link between modifications in stock prices and social media [1]. Cryptocurrency is a digital trade concept that makes use of cryptographic capabilities to conduct economic transactions. Cryptocurrencies leverage the blockchain era to the advent of age transparency, decentralization, and immutability. BTC is the maximum well-known cryptocurrency, which came into existence in 2009 through an anonymous institution or person, accomplishing its height cost on December 16, 2017, through mountaineering to nearly \$20,000. In the final ten years, 1512 alternative cryptocurrencies like Ethereum and Litecoin had

been created proving that the cryptocurrency marketplace has emerged revealing its sturdy growth [2]. The forecasting of Bitcoin price may be taken into consideration as a common sort of time-limited problem, just like the stock price prediction. Traditional time-series models, just like the famous ARIMA, had been carried out for cryptocurrencies' price and motion prediction [4,6]. After the discovery of the Blockchain era, which began approximately a decade ago, a maximum of the posted studies on this region have been targeting non-technological factors of Blockchain technology inclusive of felony troubles and its function in criminal activities [7]. Since cryptocurrencies have been first added in the year 2008 their scope has been restricted to papers posted between 2008 and 2018 [8]. This paper discusses the research methodologies used in this study and displays the result lot of the valuation of reviewed papers and their classifications. RNNs that upload the particular dealing with the sequence of observations include the LSTM. Whilst learning a mapping feature from inputs to outputs, is now no longer supplied through MLPs or CNNs [9-10]. Most commonly, statistical strategies are being in use for such a long time, from the 1970s onward, exclusively the ones primarily based totally on one Box-Jenkins methodology [11]. By reviewing rising studies of deep-learning fashions, which include their mathematical formulation, for large facts, and function learning. Another terrific work may be determined wherein the authors added the time series type hassle and furnished an open-supply framework with applied algorithms in the University of East Anglia/the University of California in Riverside source [12]. The forecasting trouble and mathematical method for time collection may be determined in the Problem Definition segment [13]. The deep-Learning Architecture phase presents the deep-studying architectures normally used in the context of time collection forecasting. A time collection is described as a chain of values determined over time. As it is a known term that time is a variable measured on a non-stop basis, the values in a time collection are tested at consistent intervals (constant sampling frequency) [14,15].

Cryptocurrencies have attracted recognition as volatile investments, because of excessive investor losses due to scams, hacks, and bugs. Although the underlying cryptography is usually secure, the technical complexity of the use of and storing crypto belongings may be a primary threat to new users. Unlike conventional finance, there may be no manner to do the opposite or cancel a cryptocurrency transaction after it has already been sent. The statistics on the blockchain are encrypted, which means no one can mess with it. During

transactions the person's Sample paragraph, the complete file ought to be in the name isn't revealed, however simplest their wallet ID is made public. At present, the costs of those cryptocurrencies do now no longer have a good-sized quantity of research and studies in comparison to standard trading markets. The process of Forecasting Time Series has continually become a crucial region of research in lots of domain names due to the fact many specific forms of information are saved as time collection [16]. For example, by discovering quite a few times collection information in medication, climate forecasting, supply chain control, biology and forecasting of stock prices, etc. with knowledge resources of developing availability of information and computing strength in the current years, Deep Learning has ended up an essential a part of the new technology of Time Series Forecasting fashions, acquiring tremendous results.

Deep learning can be the future of complicated and hard-time collection forecasting and the article will assist you to get commenced and make fast development for your personal forecasting problems. Supervised studying is wherein you have input variables (X) and an output variable (y), and you operate a set of rules to analyze the mapping characteristic from the entry to the output. Deep Learning used for forecasting Time Series overcomes the conventional Machine Learning risks with several special methods. In addition, don't forget the overall performance of the current attention-based Transformer models, which has had exact fulfillment withinside the image processing and herbal language processing domains. In all, by evaluating four special deep learning techniques (RNN, LSTM, GRU, and Transformer) at the side of a baseline approach. The process of implementing multilayer perceptron is enormously meek. However, deep-learning models are extra complex, along with their implementation calls for an excessive stage of technical information and substantial time investment to implement [17].

The authors of this research suggest a revolutionary machine-learning methodology for forecasting Bitcoin's price and behavior. A deep neural network underlies the proposed model, which was trained using a sizable dataset of historical Bitcoin price data. The model beats state-of-the-art techniques when tested on a held-out test set. Investors can utilize this model to aid them in making more educated choices regarding Bitcoin trading.

II. RELATED WORK

A cryptocurrency is a virtual foreign money, that is an opportunity shape of charge created by the usage of encryption algorithms. The use of encryption technology methods that cryptocurrencies characteristic each as foreign money and as a digital accounting system. To use cryptocurrencies, you want a cryptocurrency wallet. These wallets may be the software program that may be a cloud-based provider or is saved in your computer or cellular device. The wallets are the device via which you store your encryption keys that verify your identification and link to your cryptocurrency. In these wallets, there are two types of keys. The first one is a public key that is visible to all and helps you to identify the transaction being made from your account, or in simple words, represents your account publicly. While the other the most sensitive key is

known as the private key which in term helps you to send and receive transactions inside the blockchain. These wallets are in term only and can be used for trading in blockchain and more work as a bank account for your digital currency. What are the dangers of the usage of cryptocurrency? Cryptocurrencies are nonetheless fairly new, and the marketplace for those virtual currencies may be very volatile. Since cryptocurrencies do not want banks or some other third party to adjust them; they tend to be uninsured and are tough to transform right into a form of actual foreign money (which includes US greenbacks or euros.) In addition, considering that cryptocurrencies are technology-based intangible assets, they may be hacked like some other intangible generation assets. Finally, because you shop your cryptocurrencies in a virtual pocket, in case you lose your pockets (or access to it or pocket backups), you have misplaced your whole cryptocurrency investment.

Unlike conventional finance, there may be no manner to oppose or cancel a cryptocurrency transaction after it has already been sent. By a few estimates, approximately a 5th of all bitcoins is inaccessible because of misplaced passwords or wrong sending addresses. Bitcoin is a currency but not the basic one, it is a crypto forex that is used globally for virtual fees or truly used for investment. It is decentralized for example it isn't owned by anyone. Transactions made via way of means of Bitcoins are smooth as they may be observed in any country. Investment may be achieved thru numerous marketplaces recognized as "bitcoin exchanges".

A range of machine learning methods, such as sentiment analysis of Twitter feeds, have been developed over the years to forecast price movement for the financial markets using digital platforms. Recent research has effectively used sentiment analysis for a variety of purposes, including predicting movie box office receipts [1]. Machine learning, like deep learning techniques, is recognized as an efficient forecaster for several tasks and situations; such a toolkit provides algorithmic traders with a powerful yet fundamental set of tools to anticipate the path of price yet for capital assets. Huang, Xin, and others [2] described the purpose of LSTM Driven Sentiment Classification for Cryptocurrency Purpose of forecasting is to outline and illustrate the work of LSTM Results using data sets from social media posts, tweets, and comments. The concluded precision is 92.5 percent. In contrast to the conventional auto-regressive technique, the system used in this research is constructed via LSTM and attains better recall and precision. Wei Chen and others [3] used the data set which was gathered utilizing websites, APIs, and machine learning models. It was employed to forecast the Bitcoin exchange rate using technological and financial factors. Here, the data will be divided into 4 distinct periods concerning the year and the currency exchange rate using the methods ARIMA, SVR, ANFIS, and LSTM. Learning techniques that have been put into use according to research, the GRU model time series offers the fastest compilation of bitcoin price predictions [5].

T. Awoke et al. [10] said Bitcoin price prediction and analysis used a deep learning model where the dataset implements LSTM and GRU methods using Kaggle bitcoin price data (2014-2018 low price data) reaches up to 92% and 75% respectively. Long-term dependencies can be more

effectively identified using LSTM and GRU models. Some recent work has focused on high-frequency trading and the application of deep learning methods such as RNN to predict time series data whose functional models have been transformed into dense and feeder networks [18]. Deep learning methods are expected to outperform the deficient performance of ARIMA. McNally [19] used machine learning techniques such as recurrent neural networks (RNN) and long-term memory (LSTM) to predict the process of changing the price of Bitcoin and automatically compare the results. To enhance outcomes, such as deep learning employing neural networks (such as ANN and RNN) in prediction, apply ML algorithms (such as SVM, Bayesian Network, regress, or any other advanced machine learning approach) [20]. The same technique may be used by Hoy to forecast Bitcoin.

The market for algorithmic trading is estimated to be worth \$11.66 billion in 2020 and to increase to \$26.27 billion by 2021, according to research [21]. Bitcoin is the maximum famous instance of chain technology. "Bitcoin is a peer-to-peer digital coins system" delivered withinside the famous paper Nakamoto[22]. The peer-to-peer (P2P) mechanism permits a possession switch, from one party to every other without a third-party intervention (monetary institution). Payments may be remodeled on the internet with nonneutral or fee of a government for the primary time [23]. Deep Learning models examine capabilities and dynamics best and at once from the information. Thanks to this method, they accelerate the manner of information training and might examine extra complicated information styles in a greater whole way [24]. Before talking about Deep Learning techniques used for Forecasting Time Series, it's miles beneficial to keep in mind that the maximum classical Machine Learning models which are used to resolve this hassle are ARIMA models and additionally exponential smoothing [25]. The cryptocurrency marketplace is one of the quickest developing in the global and is taken into consideration as one of the maximum risky markets for transactions. For example, the price of bitcoins has skyrocketed, from nearly 0 in 2013 to around \$ 19,000 in 2017. For a few altcoins, the charge can upward thrust or fall through greater than 50% in a single day [26].

Deep learning models are one of, if now no longer the most data-hungry models of the Machine Learning world. They want big quantities of facts to attain their greatest overall performance and serve with the distinction, anticipate from them. However, having these many facts isn't always continually easy [27]. The purpose of machine learning is to discover styles in statistics and then make predictions, typically based on complicated styles, to reply to commercial enterprise questions, track trends, and assist them to examine and solve issues. Thus, it's far vital to look at it to discover an extensive variety of verbal facts more easily [28]. LSTM achieved overall recognition accuracy of 52% and 8% RMSE. Compared to deep learning systems, the popular ARIMA method is used for time series forecasting. This model is inefficient as deep learning models can be implemented.

III. LIMITATIONS OF PREVIOUS WORK AND OUR CONTRIBUTION

Past exchange rates are used as predictors in current research on bitcoin exchange rate forecasts. Bitcoin's creation, however, demonstrates a complicated and extremely erratic character. Therefore, it is crucial to take into account the many variables that affect the exchange rate for Bitcoin. A variety of econometric techniques, including random forests, clustering, and machine learning, have been used to investigate the factors that influence the price of Bitcoin. Here is Table I that shows us 'Previous Works' and the same method that is going to be utilized in this research for getting good results with the Forecast Data Set.

TABLE I. ANALYSIS OF PREVIOUS METHODS AND RESULTS WITH LSTM

Approach	Year	Dataset Period	Method used	Performance Evaluation
Huang et al. [2]	2021	19/03/2021 to 27/03/2021	LSTM	0.87
Fan Fang et al. [4]	2021	02/07/2018 to 29/08/2018	LSTM	0.82
Awoke et al. [10]	2020	01/01/2014-20/02/2018	LSTM	0.092
M.J. Hamayel et al. [11]	2021	01/01/2018 to 30/06/2021	LSTM	410.399

A. Our Contribution

The Long-Term Memory Network (LSTM) is a modern deep-learning architecture for time series estimates. Moreover, there hasn't been much research done on forecasting financial time series, particularly for cryptocurrencies. To predict the daily price of bitcoin using the usual LSTM model, offer a novel forecasting framework. The suggested model's effectiveness is assessed. By employing techniques relevant to the specific item, need to anticipate the value of Bitcoin. For instance, might simply wish to predict based on signals or prices, or might only be able to anticipate the current day based on LSTM, past prices, and other techniques (such as official forecasts). A closing price might also be anticipated the next day. Market trends might aid investors in choosing their investments. Be extremely precise when determining future values. Additionally, both in accuracy and precision, the LSTM model outperforms conventional LSTMs and other time series forecasting models. It uses sophisticated algorithms, statistical models, and human oversight to make trade choices on exchanges. In contrast, the Financial Times reports that, in addition to conventional hedge strategies and futures trading, quantitative trading is being utilized to trade digital currencies like Bitcoin. In-depth discussions are held about the development and assessment of statistical models, predicting, controlling, and filtering of ideal time series. The two main types of time series analysis are hyperbolic and random analysis of variance.

IV. MATERIALS AND METHODS

A. Research Methodology

The purpose of this research is to predict price changes in Crypto (Bitcoin) on the premise of Monthly, Weekly, Days, Hourly, and by Minutes time to alternate in price like multilevel (for example, the diploma of increase/decrease) and

binary (up / down). The transaction topic gives a Deep Learning Model's Techniques to predict the price dynamics of digital currencies in actual time by using the evaluation of numerous values. The LSTM cell has recall and overlooking gates, which allow the cell to choose which facts to propagate or block based on their relevance and strength [29]. Determine which information needs to be kept or forgotten, then upload it to the cell state or delete it. By enabling the recovery of data that has been copied into memory, LSTM can resolve the vanishing gradient problem [30]. Time series with unknown time delays may be classified, processed, and predicted with the help of LSTM.

B. Data Collection

Data preparation is the process of gathering, integrating, organizing, and structuring records so that they may be used for applications such as data analytics, data mining, and visualization. For the issue we're trying to address, accurate records must be fed. The preparation of the data set is a crucial stage in machine learning. As previously said, the data preparation has an impact on the accuracy of the forecasts; as a result, this part has to explain the information in the records set. The methods employed to get the data ready for the model being utilized. For the main part of this research, the publicly accessible API from BINANCE Exchange was used to gather historical and real-time rate data for Bitcoin. By collecting real-time bitcoin data from the Coinbase API, allowing one to predict price fluctuations concerning other datasets.

C. Pre-Processing

The dataset was split into training and test subsets at a ratio of 90:10 to train the models, fit them, and fine-tune their parameters. This dataset was built up over each prospect's period and continued the data-collecting process. The facts Set is existed on 5 exclusive forms and LSTM BTC Model is implemented on those all. All of the facts set are from January 2021 to March 2022. The First Data Set is set Monthly Basis Data set. The Second is set to Weekly, 0.33 is set everyday basis, the fourth is about Hourly, and the Last one is an approximately Minutes-by-minutes data set. By anticipating the Bitcoin price for the next time using the Minutes inside hours, weekly, monthly, daily, and hourly prices as input. To improve statistics processing and version convergence efficiency, a variety of pre-processing approaches are used. Minibatch is used to divide massive statistics into manageable batches, which boosts memory effectiveness. Some data in the statistics utilized in this study were missing or had no relevance because they were collected through websites and APIs.

D. Proposed Model

It is claimed that the vanishing gradient problem is avoided by a deep learning concept, particularly a Recurrent Neural Network notion. The main reason for using this set of rules is that it prevents back propagation errors from disappearing or bursting, allowing them to travel backward via an endless number of digital layers that have been opened up in space. The research is divided into three sections due to the heritage records and restricted circumstances. Information preprocessing comes first. Use a modified LSTM network for forecasting and training. The use of interpolation fitting and Fourier rework noise discount for Bitcoin price data, to

improve accuracy in the later time collection prediction. To improve forecasting results, cellular connections are added to the candidate hidden states and control gate in the unique LSTM version, and the most effective control gate is maintained. Following the procedure of purging the data set and dividing it into train data sets, LSTM-BTC is used to observe the results for each of this research paper's data sets. The specific flowchart for the entire essay can be seen in Fig. 1 to avoid using complicated descriptions and to intuitively duplicate this work method.

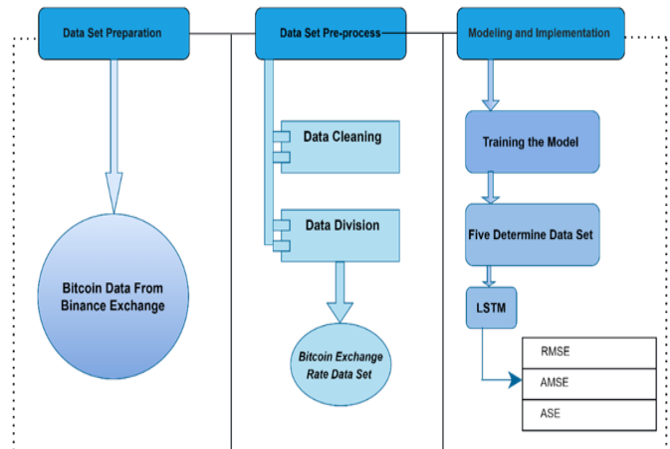


Fig. 1. Proposed LSTM-BTC model.

Long Short-Term Memory (LSTM) and Gated Recurrent Models are examples of RNN extensions (GRU). The problem of remote activities' fading effects in the RNN community is resolved by long short-term memory. It features a transfer that allows you to choose certain actions to be remembered. Additionally, it isn't usually well-established over time and doesn't require as much training. It uses four levels to determine the output before sending the hidden kingdom and the finished product to the cycle after that. To determine if the enjoyment must no longer be counted, "forgetting gates" are present similarly to four layers. Different data may be provided to four levels and forgetting gates for awareness of either short- or long-term memory. When compared to the LSTM model, the GRU or Gated Recurrent Model is seen to be one of the less challenging models since it combines the "forget" and "input" steps into a single step, which only requires the simplest hidden unit.

E. Suggested Model Reasons

- An RNN variant created expressly to address the disappearing gradient issue is the LSTM network. When the erroneous signal backpropagates across several layers of the network and shrinks too much to be meaningful, this issue might arise in RNNs. By employing gates, which manage the information flow over the network, LSTMs get around this issue.
- The redesigned LSTM network suggested in the research enhances the performance of LSTMs by including a control gate and cellular connections to the potential hidden states. This enables the network to discover more intricate correlations between the historical and predicted values of the price of Bitcoin.

- By reducing noise from the data, interpolation fitting and Fourier transform noise reduction techniques help to increase the accuracy of the forecasts.

F. Implementation Details

The implementation details are given in Table II.

TABLE II. IMPLEMENTATION DETAILS

Epoch	Initial Learning Rate	Hardware Resources
100	0.005	Single CPU

V. MATERIALS AND METHODS

A. Simulation and Results

In this Section, analyze the data set first and then optimize the price at various time intervals, including monthly, weekly, daily, hourly, and minutely. Therefore, in the first phase, by observing, the Bitcoin Price with the rate that was in effect at the time for each of the data sets that are used for this study. Fig. 2 is showing that the Proposed LSTM-BTC Bitcoin Price Rate Hourly.

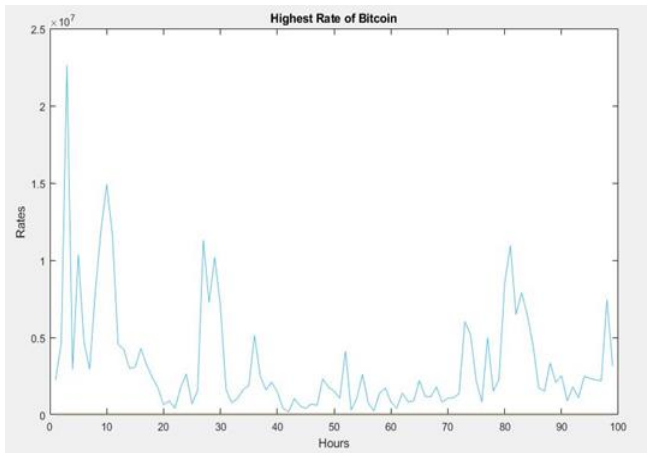


Fig. 2. Proposed LSTM-BTC Bitcoin price rate by hourly.

After that Trained the Model with LSTM on each of the Available Data sets, which will get us the results of the training that are shown below in Fig. 3 to 7.



Fig. 3. Proposed LSTM-BTC trained model with monthly basis.



Fig. 4. Proposed LSTM-BTC trained model with weekly basis data.



Fig. 5. Proposed LSTM-BTC trained model with daily basis data.



Fig. 6. Proposed LSTM-BTC trained model with hourly basis data.



Fig. 7. Proposed LSTM-BTC trained model with minutes basis data.

Determine suitable analytical strategies to study the relationship between the price of bitcoins and other important parameters. After training the model, check the price forecasting results for each outcome in the proposed Model dataset in Fig. 8 to 10.

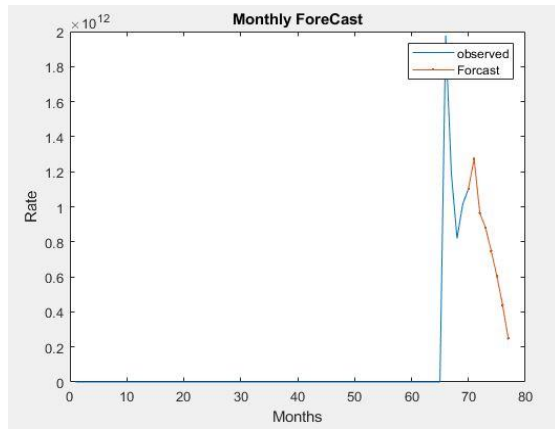


Fig. 8. Proposed LSTM-BTC after training the monthly forecast.

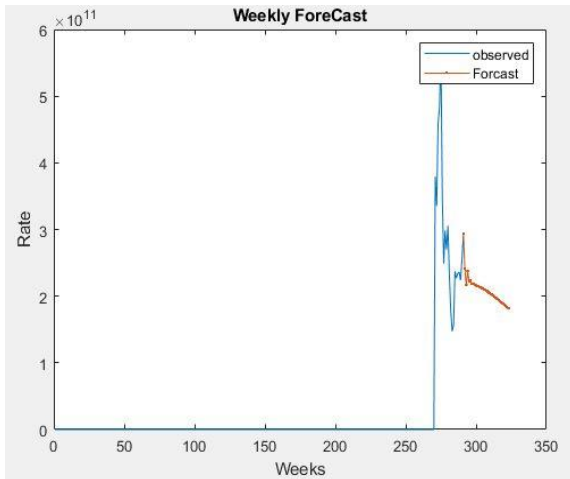


Fig. 9. Proposed LSTM-BTC after training the weekly forecast.

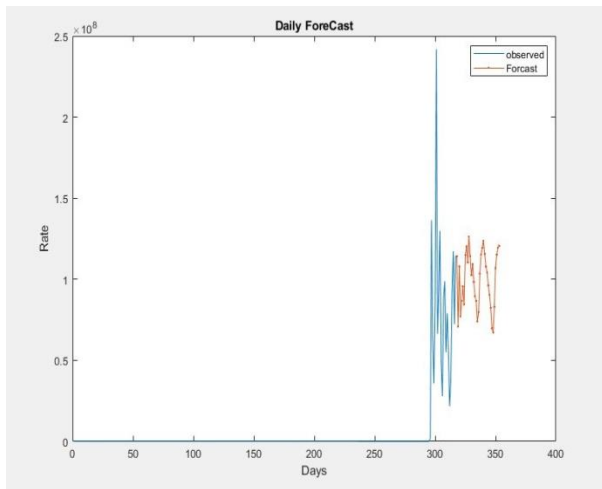


Fig. 10. Proposed LSTM-BTC after training the daily forecast.

After the trained model was applied to each data set, that observed the price forecast with respect to time was zone-specific. After that, examine the updated forecast results using RMSE (Root Mean Square) Value and Graph by applying Validation to the remaining 10% of the data set. It will apply to each one of these data sets as well. Fig. 11 shows the Proposed LSTM-BTC Model Update with Daily Forecast.

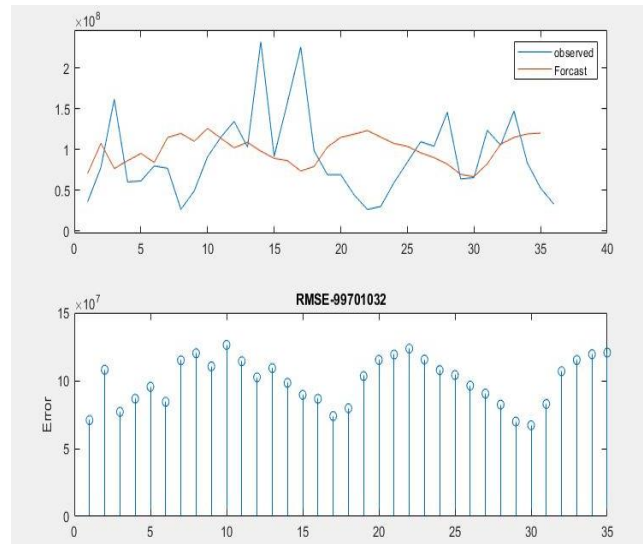


Fig. 11. Proposed LSTM-BTC daily forecast with update.

Before the results' ultimate output, attempt to quantify them using the RMSE, i.e. (root mean square error). Always, RMSE will be higher than or equivalent to MAE. The RMSE scale evaluates a model's capacity to forecast continuous values. To determine whether the margin of error makes sense, the RMSE units are identical to the data units of the dependent variable/target (i.e., if it's in dollars, it's in dollars). The effectiveness of the model improves with decreasing RMSE. Measuring the effectiveness of time series models' short- and long-term predictions is a frequent method of comparison. Utilize the performance measures MAPE (percentage mean absolute error) and RMSE (Root mean square error) to assess the performance of these two models. Utilizing LSTM, these incorrect values were discovered. Fig. 12 to 14 display the RMSE results with respect to months, hours and minutes.

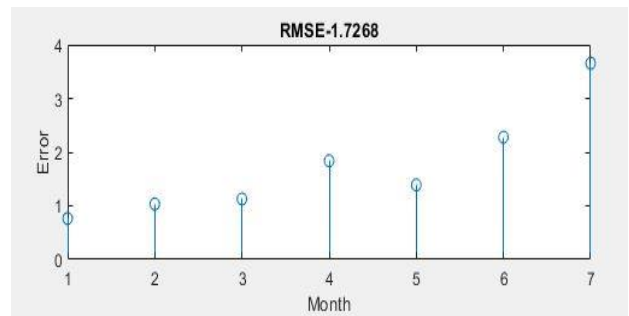


Fig. 12. Proposed LSTM-BTC RMSE of months.

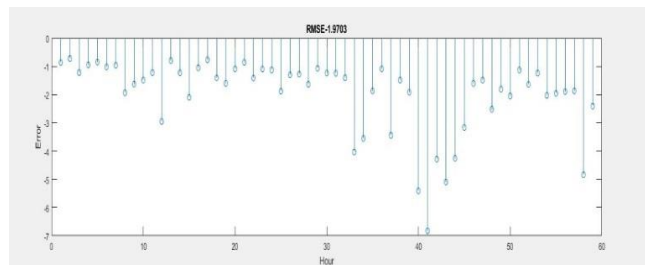


Fig. 13. Proposed LSTM-BTC RMSE of hours.

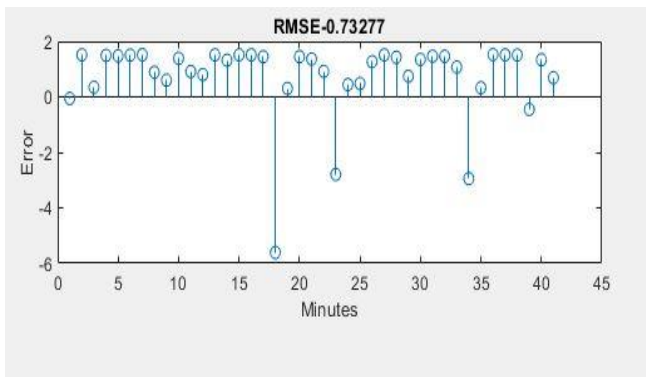


Fig. 14. Proposed LSTM-BTC RMSE of minutes.

After Standardizing the Data Set, the values Mean and Segmentize values are given in Table III.

TABLE III. STANDARDIZED VALUES

Data Set	Mean	Seg.
Monthly	102186464180.311	355077255937.377
Weekly	21721657287.3499	81315350578.9220
Daily	6025642.99833914	24936137.0634950
Hourly	379850.632288345	1768351.56637383
Minutes	33943.5608210427	25640.9457250926

Table IV shows the performance analysis of the proposed LSTM-BTC with respect to Mean, RSME, Absolute Mean Square Error (AMSE), and Absolute Square Error (MAE) for all five datasets: monthly, weekly, daily, hourly and minutes.

TABLE IV. PERFORMANCE ANALYSIS OF PROPOSED LSTM-BTC W.R.T DIFFERENT ERROR AND RESULTS WITH LSTM

Data Set	RSME	AMSE	MAE
Monthly	1.72682328867215	8.4977586e+23	6.6361072e+11
Weekly	0.543983891659373	4.2930577e+22	1.8160258e+11
Daily	0.00989690855714705	1.0233483e+16	67147840
Hourly	0.795046379048935	5.5483145e+12	476020.22
Minutes	0.732772033979149	1.6737144e+09	21938.914

It is also observed that the proposed forecasting model is reliable for a monthly-based dataset with respect to RMSE outputs based on the estimated rate analysis as well as the aforementioned forecasting outcomes.

B. Performance Analysis and Comparison

Overall, the empirical results presented in the previous section support the general hypothesis that “Bitcoin’s coverability rate is determined by various economic and technological determinants over time.” Therefore, rather than using historical exchange rates, higher forecast performance may be attained by exploiting knowledge buried in economic and technical drivers. The results here change by comparing the results here with the final execution of the research paper, so use the latest dataset for this purpose and many conditions change. Table V shows the performance analysis of the proposed method with previously published state-of-the-art approaches.

TABLE V. PERFORMANCE ANALYSIS OF PROPOSED METHOD WITH STATE-OF-THE-ART PREVIOUS PUBLISHED APPROACHES

Approach	Year	Dataset Period	Method	Data Set instances	RMSE
Huang et al. [2]	2021	19/03/2021 to 27/03/2021	LSTM	Day Wise	0.92
Fan Fang et al. [4]	2021	02/07/2018 to 03/07/2018	LSTM	By Hourly	0.82
Awoke et al. [10]	2020	01/01/2014-20/02/2018	LSTM	Day wise	0.092
M.J. Hamayel et al. [11]	2021	01/01/2018 to 30/06/2021	LSTM	Day wise	410.399
Proposed LSTM-BTC	2022	Jan 2021 to March 2022	LSTM	Monthly	1.7268
				Weekly	0.5439
				Daily	0.0098
				Hourly	0.7950
				Minutes	0.7327

VI. CONCLUSION

This study looked into the accuracy of forecasting Bitcoin exchange rates based on technological and economic variables. The DNN-based machine learning model and trained it using historical Bitcoin price data. The study does, however, have certain shortcomings. First, it is unclear how well the model would perform given future data because it was trained on historical data. Second, it is unclear how well the model would generalize to other markets because it was not tested on other cryptocurrencies. Despite these drawbacks, the study significantly adds to the body of knowledge on predicting Bitcoin prices. It thinks that its findings will be valuable to academics, investors, and decision-makers. For upcoming research, look at the use of reinforcement learning and natural language processing as additional machine learning techniques for predicting Bitcoin prices. Test the model's performance on several cryptocurrencies, including Litecoin, Ethereum, and Ripple. Create strategies for increasing the amount of real-time data that Bitcoin price prediction algorithms can use. Research the effects of variables including legislation, public opinion, and technological advancement on the volatility of the Bitcoin price. It is hoped that the effort would stimulate more investigation into this vital subject.

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