A Novel Prediction Model for Cryptocurrency Trend Analysis Based on Time Series Data by Using Machine Learning Techniques

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ABSTRACT

Bitcoin is a form of cryptocurrency that has come to be a famous inventory marketplace funding and it's been gradually growing in current years, and every now and then falling without warning, at the inventory marketplace. Because of its fluctuations, an automatic device for predicting bitcoin at the inventory marketplace is required. However, due to its volatility, traders will want a prediction device to assist them make funding selections in bitcoin or different cryptocurrencies. In this paper, Deep gaining knowledge of mechanisms like Recurrent Neural Network (RNN) and Long short-time period memory (LSTM) is proposed to broaden a version to forecast the bitcoin charge fashion withinside the marketplace. Finally, the predictions end result for the Bitcoin charge fashion are supplied over the subsequent 15, 30, and 60 days. Each version is evaluated in phrases of Mean Absolute Percentage Error (MAPE) and Root Mean Squared Error (RMSE) forecasting blunders values. The LSTM version is observed to be the higher mechanism for time-collection cryptocurrency charge prediction, however it takes longer to compile. The goal of this project is to show how a trained machine model can predict the price of a cryptocurrency if we give the right amount of data and computational power. It displays a graph with the predicted values. The most popular technology is the kind of technological solution that could help mankind predict future events. With vast amount of data being generated and recorded on a daily basis, we have finally come close to an era where predictions can be accurate and be generated based on concrete factual data. Furthermore, with the rise of the crypto digital era more heads have turned towards the digital market for investments. This gives us the opportunity to create a model capable of predicting crypto currencies primarily Bitcoin. This can be accomplished by using a series of machine learning techniques and methodologies.

Keywords : Bitcoin, blockchain, cryptocurrency, LSTM, machine Learning, prediction, RNN.

I. INTRODUCTION

With the advent of Bitcoin ten years ago, the arena of economics underwent and keeps to go through a revolution, albeit on a small scale. Bitcoin is a cryptocurrency and a sort of digital money [1]. It is a virtual foreign money that may be dispatched from consumer to consumer at the Bitcoin peer-to-peer community without the usage of intermediaries. It maintains a file of peer-to-peer transactions, and every file is encrypted. Each new file carries the cryptographic hash of the preceding block. Each file consists of a timestamp in addition to records approximately the sender, receiver, and sum of money transferred. Bitcoin is the maximum famous cryptocurrency withinside the world [2]. It turned into first delivered in 2008 and exploited as open-supply in 2009 through someone referred to as Satoshi Nakamoto, however it has become extraordinarily famous in 2017. Bitcoin operates as a decentralized digital coins channel, with transactions proved and transcribed in a public disbursed ledger (blockchain) without the intervention of a 3rd party. Transaction blocks are made of a stable shell set of rules this is used to attach them, and blocks are served as non-editable information this is recorded whilst the transaction is held.

Then, any digital foreign money, specifically bitcoin, turned into followed through the public, and the digital foreign money marketplace fashion grew. Bitcoin turned into delivered because the device that solved the Double Spend problem [3], a not unusual place trouble with inherent Digital Cash systems. Nonetheless, the effect withinside the following years turned into greater. Distributed Ledger Technologies (DLT), Smart Contracts, Cryptocurrencies, and different technology all seemed from the "Bitcoin idea." This is because of the wonderful decentralization mixed with intuitive incentives. Bitcoin's recognition has risen in a quick duration of time. Bitcoin is connected to a number of technology and businesses.

According to numerous researchers, round 100,000 generation and commercial enterprise agencies joined the bitcoin marketplace after 2015 [4]. Amazon, Microsoft, Overstock, Dell, and different famous agencies have partnered with bitcoin [5]. The number one venture of the bitcoin change charge is its excessive charge of charge fluctuation. Because of the excessive charge volatility, positive precautions ought to be taken a good way to correctly expect the charge of bitcoin. Knowing the forecasting hobby is needed to inform approximately the destiny charge of bitcoin and to construct agree with and reputation everywhere in the world. A type of factors, inclusive of a country's political device, public family members, and marketplace policy, can affect the financial position of bitcoin and the worldwide family members of nations on numerous marketplace strategies.

Finally, there's no legitimate avenue map: some key demanding situations and traits for bitcoin prediction are steady due to the fact there's no clean description of the change platform on which transactions associated with shopping for and promoting aren't regulated. The intention of this paper is to forecast the bitcoin charge greater exactly the use of deep getting to know fashions whilst minimizing dangers for buyers and decision-makers.

Building algorithms and models to predict prices and future events has been given significant amount of attention in the past decade. With user data being collected through various forms of paths, there has never been an abundance in raw data like there is now. Any model capable of predicting a future event whether it be to find out what the next big trend is or to predict the next behavior of a customer, most predictive models possess great potential to change opportunity into revenue.

II. MOTIVATION OF THE WORK

The objective of this project is predicting the bitcoin prices based on the data and providing information to user that on which direction it will move.

In a multidisciplinary education context, project based learning appears one of the most interesting instructional strategies which tries to engage students in authentic real world tasks to enhance learning. In project based learning students typically engage individually or in groups with an instructor or coach or mentor. Each of the project designs and implements an approach to understand practical professional environment in the field of computer science engineering. In this paper, our students have applied project based learning to develop a bit coin pricing algorithm; in addition to technical knowledge, they also learned to manage resources and time execution and work in teams.

Many research were performed so that you can expect time collection in addition to Bitcoin (BTC) price. Deep gaining knowledge of fashions, on the alternative hand, have now no longer been extensively used to forecast the price of Bitcoin. Knowing that deep gaining knowledge of fashions have advanced into modern neural community structure that improves prediction accuracy in numerous domains, inclusive of time collection, we don't forget deep gaining knowledge of programs to expect the BTC charge price. In the subsequent sections, preceding paintings on Bitcoin charge prediction could be reviewed, and deep gaining knowledge of fashions for time collection prediction could be discussed.

III. RELATED WORK

Madan et al. [6] tried to expect the charge of bitcoin the usage of device gaining knowledge of and to analyze the BTC surrounding trends. They forecasted the day by day charge variant the usage of 25 bitcoin-associated attributes. According to Roth et al. [7], bitcoin is the brand new and maximum famous digital forex, however its safety and volatility charge are debatable. This studies makes it feasible to behavior peer-to-peer bitcoin transactions the usage of the community and blockchain technology. Goodfellow et al. [8] recommended a deep direct reinforcement gaining knowledge of paradigm for economic sign encoding and trading. They applied reinforcement gaining knowledge of (RL), deep gaining knowledge of (DL), and their cutting-edge deep neural community (NN) to achieve actual prediction results. They validate the recommended technique the usage of records from commodity futures markets in addition to the inventory marketplace. According to Pant et al. [9], socially built thoughts approximately digital forex on Twitter have an instantaneous or oblique effect on all marketplace analyses of digital currencies. The cause of this studies is to forecast the fluctuating price of bitcoin the usage of sentiment evaluation and to pick out the connection among high-quality and bad sentiments. Dennys et al. [10] used numerous characteristic choice mechanisms to achieve the maximum critical capabilities and device gaining knowledge of strategies together with synthetic neural community (ANN), assist vector device (SVM), and recurrent neural community (RNN), and k-method clustering in bitcoin charge prediction.

S. Lahmiri and S. Bekiros [11] anticipated the route of the Bitcoin charge in USD the usage of a Bayesian optimized recurrent neural community and LSTM. They additionally in comparison deep gaining knowledge of strategies the usage of the ARIMA model. According to Atsalakis et al. [12], this examine makes a speciality of computational intelligence strategies, particularly hybrid neuro-fuzzy controllers, to expect bitcoin change rates. The neuro-fuzzy technique and synthetic neural networks had been used on this model. According to R. Nikita, S. J. Subhashini [13], The studies is dedicated to the issues associated with predicting cryptocurrency expenses the usage of device gaining knowledge of and records

science. The major algorithms used are RNN and GRU. The major purpose is to mix RNN and GRU Algorithms to shape a hybrid and in all likelihood boom the accuracy of the predictions.

IV. LITERATURE SURVEY

Pagnotta, E. and A. Buraschi , An Equilibrium Valuation of Bitcoin and Decentralized Network Assets, address the valuation of bitcoins and other blockchain tokens in a new type of production economy: a decentralized financial network (DN). An identifying property of these assets is that contributors to the DN trust (miners) receive units of the same asset used by consumers of DN services. Therefore, the overall production (hashrate) and the bitcoin price are jointly determined. We characterize the demand for bitcoins and the supply of hashrate and show that the equilibrium price is obtained by solving a fixed-point problem and study its determinants. Price-hashrate "spirals" amplify demand and supply shocks.

Gur Huberman,2019, An Economic Analysis of the Bitcoin Payment System, explained unlike traditional payment systems, Bitcoin has no owner and is governed by a computer protocol. This paper models Bitcoin as a platform that intermediates between users and computer servers ("miners") which operate the Bitcoin payment system (BPS), and studies the novel market design of this owner-less platform. We find that the BPS can eliminate inefficiencies due to market power, but incurs other costs. Having fixed transaction processing capacity, the BPS experiences service delays which motivate users to pay for service priority. Free entry implies that miners cannot profitably affect the level of fees paid by users. The paper derives closed form formulas of the fees and waiting times and studies their properties; compares pricing under the BPS to that under a traditional payment system operated by a profit maximizing firm; and suggests protocol design modification to enhance the platform's efficiency. The appendix describes and explains the main attributes of Bitcoin and the underlying blockchain technology.

Huberman, G., J. D. Leshno ,2017, Monopoly without a monopolist : An economic analysis of the bitcoin payment system, owned by nobody and controlled by an almost immutable protocol the Bitcoin payment system is a platform with two main constituencies: users and profit seeking miners who maintain the system's infrastructure. The paper seeks to understand the economics of the system: How does the system raise revenue to pay for its infrastructure? How are usage fees determined? How much infrastructure is deployed? What are the implications of changing parameters in the protocol? A simplified economic model that captures the system's properties answers these questions. Transaction fees and infrastructure level are determined in an equilibrium of a congestion queueing game derived from the system's limited throughput. The system eliminates dead-weight loss from monopoly, but introduces other inefficiencies and requires congestion to raise revenue and fund infrastructure. We explore the future potential of such systems and provide design suggestions.

Huang, J.-Z. and Z. J. Huang ,2018, Testing Moving Average Trading Strategies on ETFs, this paper tests the technical trading rule of moving average (MA) in a long-only portfolio using exchange traded funds (ETFs). We also propose a quasi-intraday version of the MA strategy (QUIMA) that allows investors to trade immediately upon observing MA crossover signals. We find that 1) this QUIMA strategy outperforms the traditional version of the MA strategy that only trades at the close of a trading day, when the long-term MA lag length is not too long, 2) the documented profitability of MA strategy on indices is greatly reduced on ETFs, mainly due to more frequent and larger opening gaps on ETF prices than those on indices, and 3) relative to the buy-and-hold strategy, MA strategies have lower return, but better risk-adjusted performance measures such as the CAPM alpha. In addition, we find that among various long-term MA lengths, the 10-day MA turns out to be

overly exploited by investors as its performance is significantly lower than those of surrounding MA lengths. Overall, our findings indicate that profitability of the MA trading rule reduces on tradable ETFs than on non-tradable indices.

Athey, S., I. Parashkevov, V, Bitcoin Pricing, Adoption, and Usage: Theory and Evidence, this paper develops a model of user adoption and use of virtual currency (such as Bitcoin), and focusing on the dynamics of adoption in the presence of frictions arising from exchange rate uncertainty. The theoretical model can be used to analyze how market fundamentals determine the exchange rate of fiat currency to Bitcoin. Empirical evidence from Bitcoin prices and utilization provides mixed evidence about the ability of the model to explain prices. Further analysis of the history of all individual transactions on Bitcoin's public ledger establishes patterns of adoption and utilization across user types, transaction type, and geography. We show that as of mid-2015, active usage was not growing quickly, and that investors and infrequent users held the majority of Bitcoins. We document the extent to which the attributes of the anonymous users of Bitcoin can be inferred through their behavior, and we find that users who engage in illegal activity are more likely to try to protect their financial privacy.

V. PROPOSED SYSTEM

Building algorithms and models to predict prices and future events has been given significant amount of attention in the past decade. With user data being collected through various forms of paths, there has never been abundance in raw data like there is now. Any model capable of predicting a future event whether it be to find out what the next big trend is or to predict the next behavior of a customer, most predictive models possess great potential to change opportunity into revenue.

RNN

RNN is a deep neural community that could study sequences designed to seize temporal contextual records together with time-collection data. It is outstanding via way of means of a recurrent connection among the enter and output of its neurons or layers. They have currently received recognition in deep getting to know due to their capacity to conquer the constraints of present neural community structure while getting to know over lengthy sequences.

LSTM

LSTMs are explicitly designed to keep away from the trouble of lengthy-time period dependency. Remembering records for prolonged intervals of time is almost their default behavior; it isn't always some thing they ought to paintings difficult to study. All recurrent neural networks take the shape of a series of repeating neural community modules. This repeating module in fashionable RNNs may have a completely easy structure, which includes a unmarried tan h layer. Deep getting to know LSTM neural networks clear up the trouble of vanishing gradients in RNNs via way of means of changing nodes withinside the RNN with reminiscence cells and a gating mechanism. In this regard, it's miles an attractive deep getting to know neural structure as a result of its efficacy in concurrently memorizing lengthy- and short-time period temporal records, which may be visible withinside the LSTM structure

The proposed method makes use of special deep getting to know-primarily based totally prediction fashions to forecast the every day charge of bitcoin via way of means of figuring out and comparing applicable features. We can decide which version is a good deal extra correct for the destiny achievement of our goal after making use of each fashions for bitcoin prediction and deciding on suitable parameters to attain a higher performance. In this paper, deep getting to know mechanisms are proposed like RNN and LSTM, which might be the maximum current and green strategies for forecasting bitcoin prices. Because

bitcoin is the maximum famous cryptocurrency, the charge volatility difficulty ought to be resolved quickly.
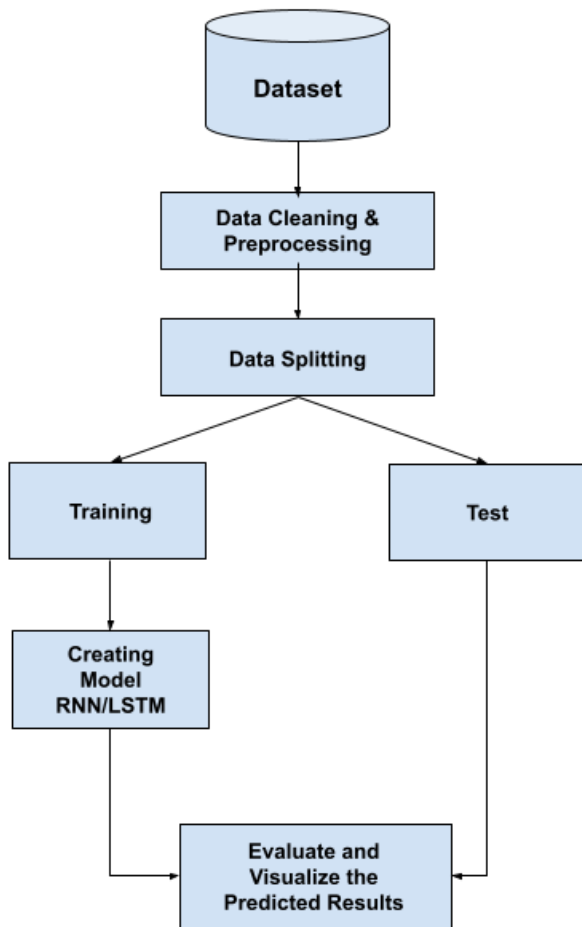

Fig 1. Complete work flow of the system

Data Training and Splitting The main goal is to test the ability of the algorithm to predict the next 15,30 and 60 days and calculate the MAE error and RMSE for both RNN and LSTM algorithms. So I split the time series into training and validation sets with ratios of 80% and 20% respectively. The experiment was repeated again several times but the dataset was truncated to consider historical data from only the last year, 2 years, 3 years, and 4 years to remove monotonic data from the initial bitcoin years then the same algorithm was used again to calculate the MAE and RMSE errors and compare between the 4-time series periods to determine the best period performance.

Input Layer: The input layer is the inner one and it will be RNN or LSTM with 32 nodes and a sigmoid activation function.

Dropout Layer: Typically, this is used before the Dense layer. As for Keras, a dropout can be added after any hidden layer, in our case, it is after the input layer.

Dense Layer: This is the regular fully connected layer.

Activation Layer: Because we are solving a regression problem, the last layer should give the linear combination of the activations of the previous layer with the weight vectors. Therefore, this activation is a linear one. Alternatively, it could be passed as a parameter to the previous Dense layer.
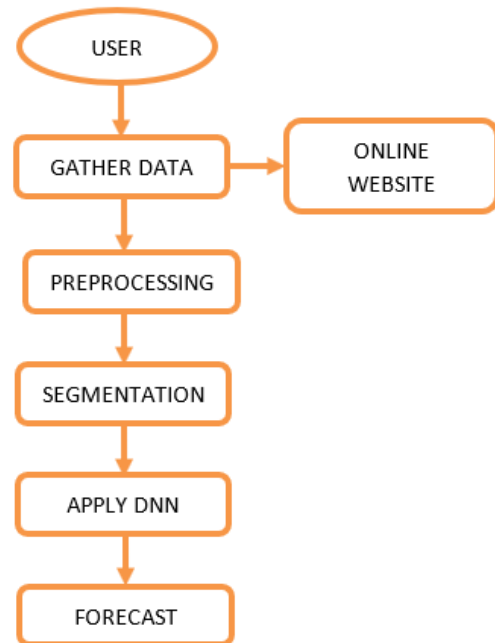

Fig 2. Architecture of the model

DNN

A deep neural network (DNN) is an ANN with multiple hidden layers between the input and output layers. Similar to shallow ANNs, DNNs can model complex non-linear relationships. The main purpose of a neural network is to receive a set of inputs, perform progressively complex calculations on them, and give output to solve real world problems like classification. We restrict ourselves to feed forward neural networks.

VI. IMPLEMENTATION

This project is implements like application using python and the Server process is maintained using the SOCKET & SERVERSOCKET and the Design part is played by Cascading Style Sheet.
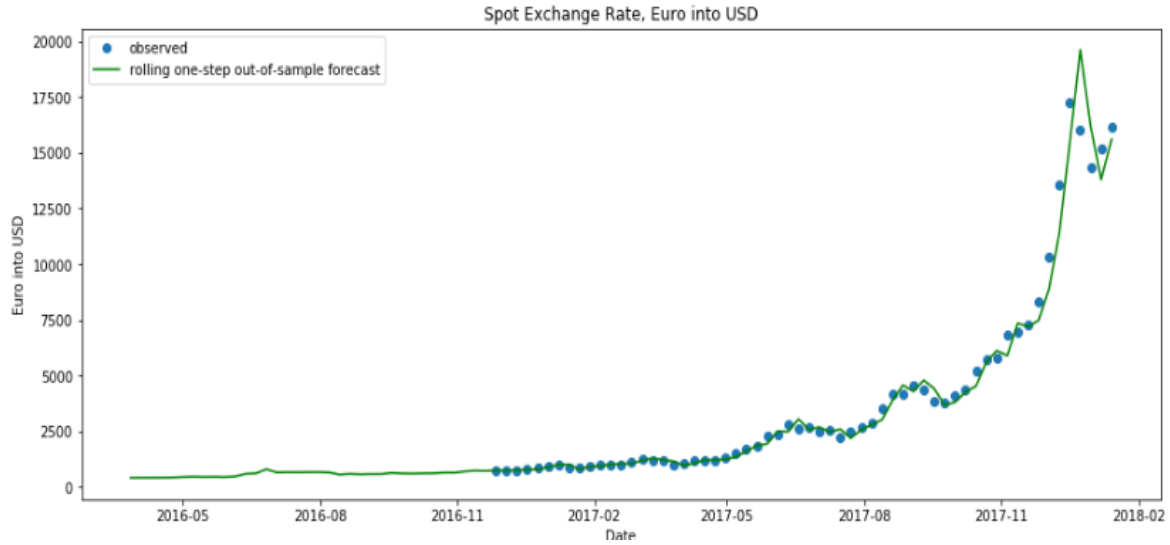

Fig 3. Spot exchange rates

	Timestamp	Open	High	Low	Close	Volume_ (BTC)	Volume_(Currency)	Weighted_ Price
3528720	1537429440	NaN	NaN	NaN	NaN	NaN	NaN	NaN
1303746	1403542680	NaN	NaN	NaN	NaN	NaN	NaN	NaN
4321484	1584995280	6343.58	6348.50	6326.84	6326.84	1.661642	10525.111 434	6334.1643 53
3432882	1531679160	NaN	NaN	NaN	NaN	NaN	NaN	NaN
770464	1371545760	103.37	103.37	102.79	102.79	1.617235	166.87855 2	103.18757 1

Table 1.Comparison of RMSE and MAPE values obtained using RNN and LSTM models of Partial Dataset 24 Months
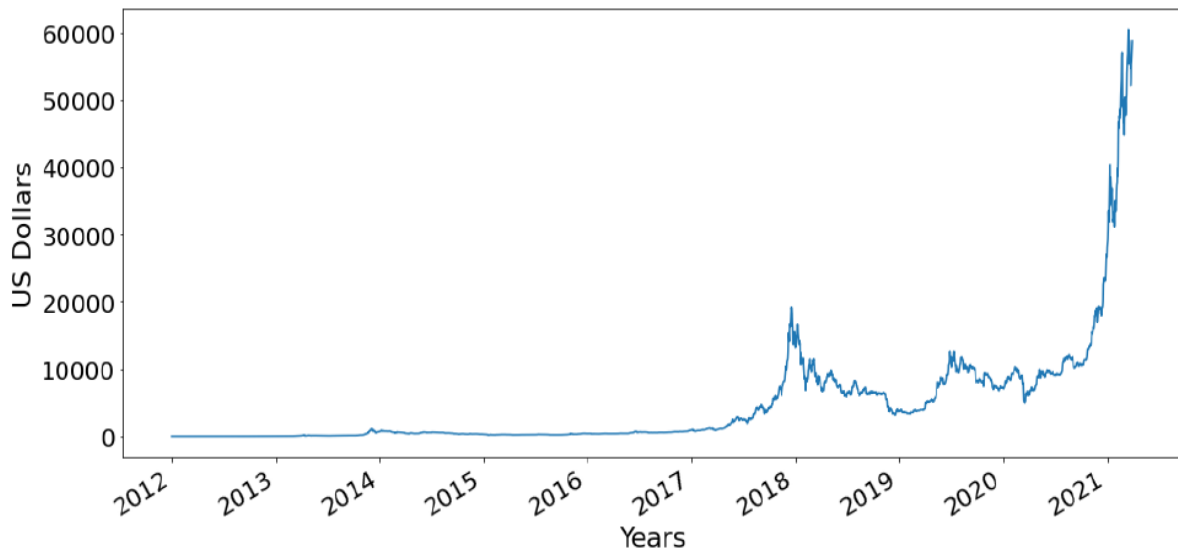
Fig 4. Year wise study

In this section, we show the results of the RNN and LSTM models. On the full dataset, Fig. 3 & Fig. 4 demonstrate how RNN and LSTM models perform when forecasting bitcoin prices by comparing the predicted BTC price with the real BTC price for the next 30 days.
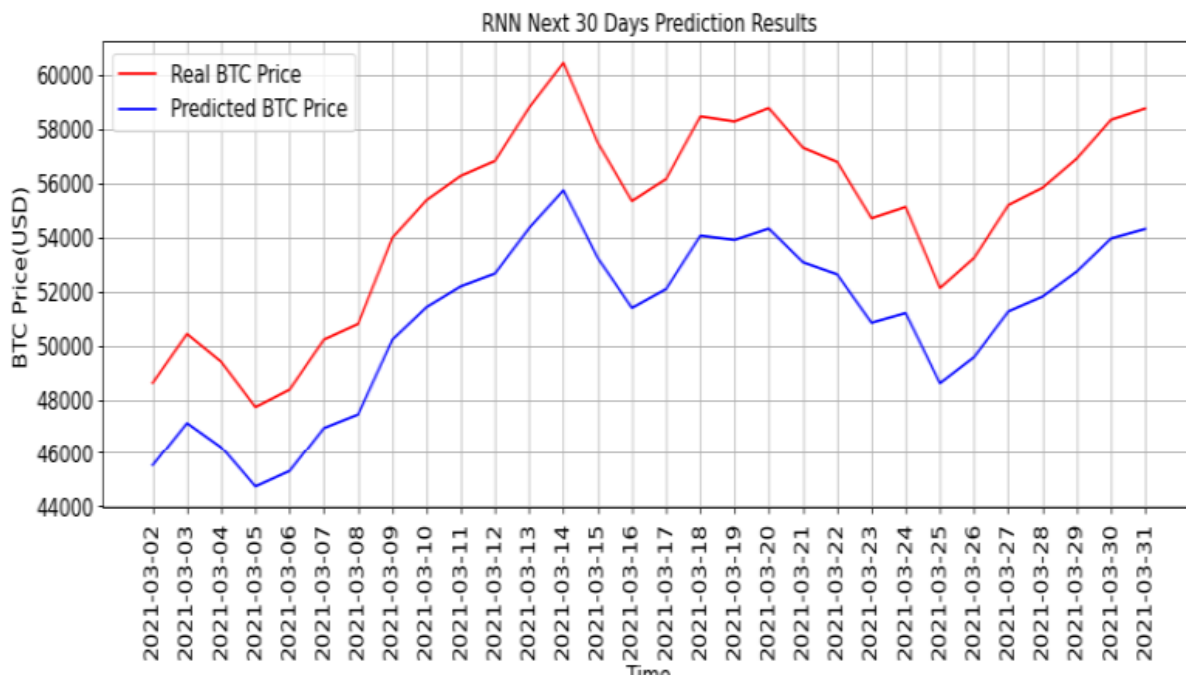

Fig. 5. Full Dataset - RNN Results for the next 30 days

Full Dataset						
Prediction period	RNN			LSTM		
	MAE	RMSE	Time (Min)	MAPE	RMSE	Time (Min)
Next 15 years	8.29%	5,15.35524	2,853	1.85%	882.127	8.995
Next 30 years	7.15%	4,938.012	2.014	2.55%	1,554.367	8.812
Next 60 years	7.12%	3,592.124	2.802	3.55%	1,881.995	8.884

Table 2 Comparison of works

The experiment will be repeated again several times to improve the results by truncating the dataset to consider data from only the last year, 2 years, 3 years, or 4 years to decide which one will improve the result and be faster in prediction. Then we repeated the experiment three times to predict the next 15, 30, and 60 days for both RNN and LSTM algorithms. Finally, to determine which model is more accurate, the root means square error (RMSE) and mean absolute percentage error (MAPE) are calculated for each of the proposed models. A complete comparison is introduced in Table 3, Table 4, and Table 5 which summarizes the predicted results of the three periods for both RNN and LSTM as well as the consumed time.
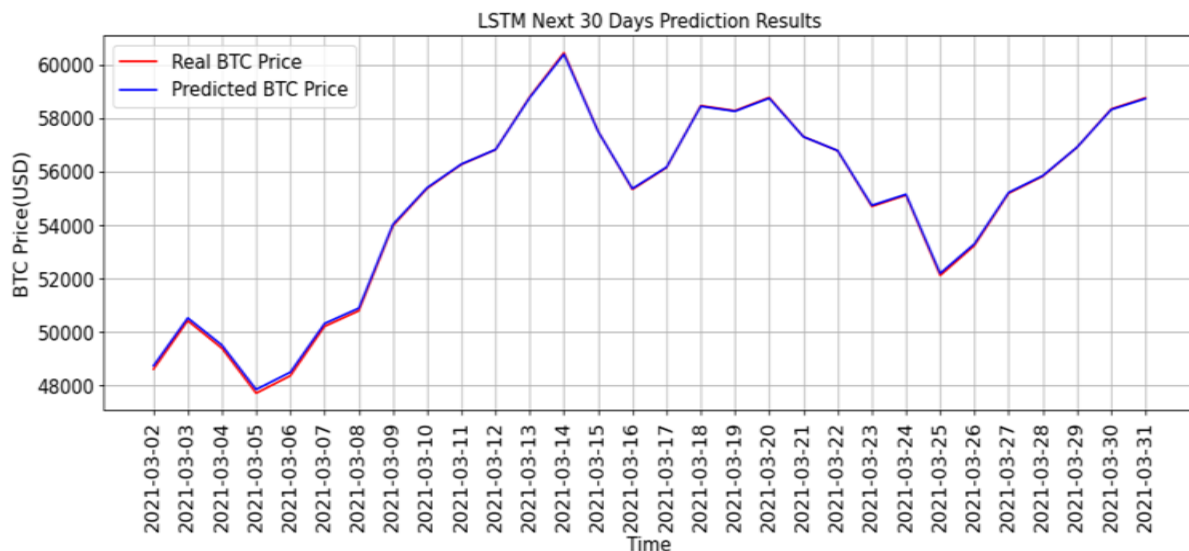

Fig. 6. Partial Dataset Last 36 Months - LSTM Results for the next 30 days

VII. CONCLUSION

Bitcoin is the maximum extensively used decentralized digital currency, which performs a full-size function withinside the marketplace financial system and removes the want for a 3rd birthday celebration to behave as a middleman among customers. Predicting the future will always be on the top of the list of uses for machine learning algorithms. Here in this project we have attempted to predict the prices of Bitcoins using two deep learning methodologies. This work focuses on the development of project based learning in the field of computer science engineering, by taking into account the problem definition, progression, student assessment and use of hands on activities based on use of deep learning algorithm to develop application which can predict bitcoin prices. The primary purpose of our studies is to enhance the accuracy of bitcoin rate forecasting the use of deep gaining knowledge of

fashions even as reducing dangers for traders and policymakers. As prediction fashions, we used deep gaining knowledge of strategies consisting of RNN and LSTM. The LSTM version is discovered to be the higher mechanism for time-collection cryptocurrency rate prediction, however it takes longer to compile. Basic deep gaining knowledge of-primarily based totally fashions, consisting of RNN and LSTM are most effective as compared on this study. However, greater studies is wanted to enhance the accuracy of deep gaining knowledge of-primarily based totally prediction fashions with the aid of using contemplating extra parameters. Other cryptocurrencies consisting of Ripple, Ethereum, Lite Coin, and others have been now no longer taken into consideration in our studies. We'll enhance the version with the aid of using making use of it to those cryptocurrencies, making it greater stable.

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