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PRICE PROGNOSTICATION OF CURRENCY WITH DEEP LEARNING

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Abstract

In this modern era of technology, the more secured ways are needed to deal with financial investments or transactions. Cryptocurrency can be named as one of the solutions for this concern. Cryptocurrency is a digital payment system that doesn't rely on banks to verify transactions. A digital payment system called cryptocurrency doesn't rely on banks to validate transactions. Anyone can send and receive funds using this method. Payments made using cryptocurrencies only exist as digital records in an online database that detail specific transactions. This new sort of investment is providing vast areas for research to the researchers. By predicting its price this can be as more efficient asset for investment. Much research is going on in this area. This paper proposes two different recurrent neural network (RNN) algorithms to predict prices of cryptocurrency namely Bit coin and they are Long short-term memory (LSTM) and Gated Recurrent Unit (GRU). the measures being used in this paper to assess the accuracy of the used algorithms are mean squared error (MSE), Mean Absolute Percentage Error (MAPE), Root Mean Squared Error (RMSE), and Mean Absolute Error (MAE), are also used to assess different prediction algorithms. Comparisons are carried out on the basis of three datasets training, testing, and validation. The loss and evaluation functions are based on the mean squared error. The model performs better the lower the value. Based on findings the GRU model outperforms the LSTM algorithm in terms of accuracy and reliability in predicting cryptocurrency prices, but both algorithms produce excellent outcomes.

Keywords:

Cryptocurrency, Bitcoin, LSTM, GRU, RNN

1. INTRODUCTION

Virtual currencies are a kind of cryptocurrency that, despite its limitations, is a remarkable technical achievement in the field of digital marketing. Virtual currencies will continue to exist, but they will never be able to entirely replace fiat or traditional currencies. Satoshi Nakamoto proposed a system that transformed the current system on October 31, 2008, with the invention of Block-chain technology and the first digital currency Bitcoin. Blockchain technology applications go further in the peer-to-peer system of payment. A blockchain is on a really basic level a scattered information of records or open record everything thought of or modernized occasions that are dead and shared among sharing parties.

The real advantage of this system is to be decentralized and fully secure of whole environment which only allows that the new blocks append. The blockchain applications ranges are at the head of many blockchain and cryptocurrencies.

Cryptocurrency is a string of encrypted data used to represent a unit of money. A peer-to-peer network called a block chain, which also functions as a secure record of transactions, such as buying, selling, and transferring, oversees and manages it [1].

The best cryptocurrency forecast uses a variety of technical indicators, including Bollinger bands, fib retracement, moving averages, etc. When joining the market and executing the appropriate actions, they execute three basic functions: prediction, confirmation, and creating alerts for investors and traders [1].

The main benefit of this system is its decentralized nature and complete environmental security, which only permits the appending of new blocks. Many blockchain and cryptocurrencies are led by the blockchain applications categories.

Bitcoin is a peer-to-peer cryptocurrency in which no third entity regulates or controls any transactions. It is not feasible for a third party to intrude between consumers. The market price is extremely volatile and operates 24 hours a day, seven days a week. Bitcoin's market capitalization rises and falls.

Deep learning algorithms have yet to be widely employed to forecast cryptocurrency market values. We investigate applications of deep learning to forecast the cryptocurrency market value, knowing that deep learning models have evolved into state-of-the-art neural network design that enhances prediction accuracy in a variety of domains, including time series.

The proposed system is based on prior research on cryptocurrency price prediction, as well as deep learning models for predicting time series. The primary difficulty with cryptocurrency exchange rates is their fast pace of price volatility. Because of the high price volatility, various precautions should be followed in order to properly anticipate the price of cryptocurrency. Understanding forecasting activities is essential for forecasting bitcoin prices as well as building trust and acceptance globally. The economic function of Bitcoin and global interactions on different market techniques can be influenced by a variety of factors, including a nation's political system, public relations strategy, and market policy. To get a greater insight into the issues of crypto-vulnerability, currency risk detection, mitigation, regulation, and acceptance, future researchers should come up with the range of approaches. Prediction of bit coin prices benefits the investors by giving opportunity to them to make decisions on their investments. To maximize profits and reduce risk, traders and investors are interested in making accurate bitcoin price predictions.

This section presents overview of cryptocurrencies whereas the remaining part of paper is designed as section 2 states the challenges faced in price prediction of cryptocurrency, section 3 presents the Methodology used to in the proposed study followed by section 4 description of the data set used in the study and section 5 gives the result analysis followed by conclusion.

2. CHALLENGES

Regardless of the opportunities in cryptocurrency, cryptocurrency still faces many challenges that need to be faced. Curious and new investors have taken prudent measures to invest massively or not due to risks and challenges associated with trading and investing in cryptocurrencies. Future studies should devise a variety of strategies in order to gain a deeper

understanding of the problems related to cryptocurrency vulnerability, risk identification, mitigation, regulation, and acceptability. Research that shows the downsides and upsides of altcoins, a digital currency that competes with bitcoin, is necessary for government actors. Furthermore, a comprehensive mapping of this spread will help business actors, among others, better recognize and manage impending volatility concerns as well as make wise policy decisions in this rapidly evolving area. A model to examine the antecedents in various situations using more sophisticated statistical modelling techniques, such as structural equation modelling or partial least squares, is also urgently needed.

2.1 PROBLEM STATEMENT

To develop a model that will enable us to anticipate the price of the cryptocurrency being used (in this example, Bitcoin), with a low error rate and high precision and accuracy. Although the model is unable to foretell our future, it can point to broad trends and the general way that prices are likely to move.

2.2 OBJECTIVES

The main objectives of this study are:

- To transform cryptocurrency into a publicly traded good with predictable price.
- To employ a machine learning technique to anticipate the direction of the price of a cryptocurrency.
- Do digital currencies like Bitcoins have the potential to displace US dollars and other conventional currencies as the principal form of transaction with weekly price prediction? Our goal is to find a solution to this question.
- To create an automated application that uses machine learning to forecast an upsurge in cryptocurrency prices relative to various time series.
- To guarantee lower risk and higher returns for investors.

3. METHODOLOGY

In this study, we used historical bitcoin prices to train two different models for two different types of price prediction in order to accomplish the goals of this work. The suggested technique analyses two alternative deep learning-based prediction models to estimate daily cryptocurrency prices by the model itself identifying and assessing important variables. We can identify which model is much more accurate for the future fulfilment of our aim after using both models for cryptocurrency prediction as well as selecting appropriate parameters to get a higher performance. The block diagram for proposed model is depicted in Fig.1.

The research offers deep learning methods associated with Recurrent Neural Networks (RNN) such as Long Short – Term Memory (LSTM) and Gated Recurrent Unit (GRU), which are the most recent and efficient algorithms for cryptocurrency price predictions. Since Bitcoin is the most widely used cryptocurrency, the issue of price volatility must be addressed quickly.

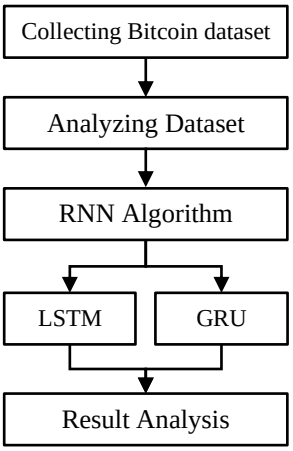

Fig.1. Block diagram for proposed model

3.1 MACHINE LEARNING ALGORITHM

3.1.1 RNN:

An artificial neural network that employs sequential data or time series data is called a recurrent neural network (RNN) [3]. Because they use data from earlier inputs to affect the present input and output, they are distinguished by their "memory". Recurrent neural networks' outputs are dependent on the previous parts in the sequence, unlike typical deep neural networks, which presume that inputs and outputs are independent of one another. This approach looks appropriate for the proposed study.

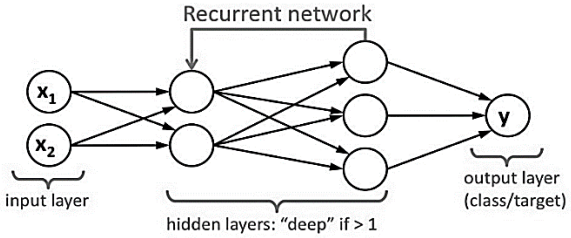

Fig.2. Recurrent Neural Networks [3]

3.1.2 LSTM:

The LSTM is a Recurrent Neural Networks (RNN) style architecture with gates that govern the flow of information between cells. A cell, an input gate, an output gate, and a forget gate make up a typical LSTM unit. The three gates control how information enters and leaves the cell, and the cell stores values across arbitrary time intervals. The input and forget gate structures can modify information traveling along the cell state, with the ultimate output being a filtered version of the cell state based on inputs [2].

A Gated Recurrent Unit (GRU) is a Recurrent Neural Network (RNN) architecture type. GRU can process sequential data such as time series, natural language, and speech. The main difference between a GRU and other RNN architectures, such as the Long Short-Term Memory (LSTM) network, is how the network handles information flow through time. The Gated Recurrent Unit (GRU) cell is the basic building block of a GRU network. It comprises three main components: an update gate, a reset gate, and a candidate hidden state.

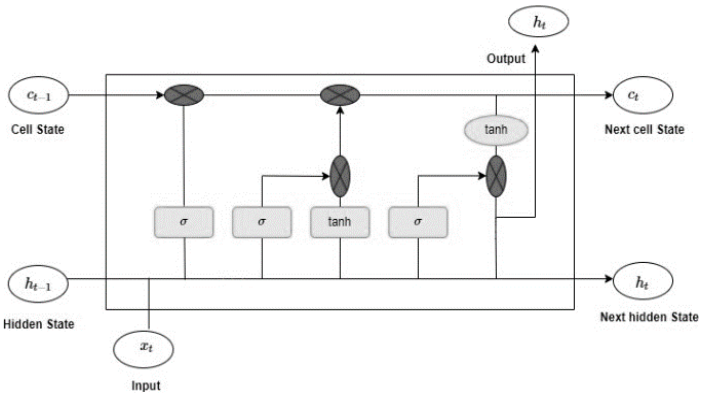

Fig.3. Long Short-Term Memory (LSTM) cell [2]

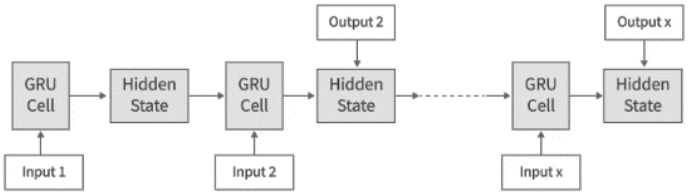

Fig.4. Gated Recurrent Unit (GRU) [4]

4. DATASET DESCRIPTION

Every machine learning or deep learning project is built around the data. In this case study, we web scraped the USD/INR exchange rates for the 10-year period from May 1, 2013 to May 1, 2023 from the website in.investing.com. The sample entries of the dataset are shown in the table below.

Table.1. Raw-dataset

	Date	Open	High	Low	Close	Adj Close	Volume
0	2023-06-30	21:00	21:18	20.83	20.96	20.96	59700
1	2023-07-03	21:16	21:16	20.83	20.90	20.90	58900
2	2023-07-05	20:75	21:03	20.73	20.96	20.96	77500
3	2023-07-06	20:76	20:83	20.66	20.66	20.66	75200
4	2023-07-07	20:86	20.96	20.85	20.85	20.85	104200

The first column, date, needs to be changed to an index in order to solve the time-series problem. There are two ways to accomplish this. In one manner, index_col= 'Date' and = True can be specified while reading a CSV file in Pandas. These two options tell Pandas to preprocess your DateTime column, or Date, during import and set it to the index of the data frame.

Table.2. Raw-dataset

	Open	High	Low	Close
0	11617.56	11693.94	11593.01	11678.72
1	11609.99	11644.65	11466.00	11617.56
2	11562.86	11620.00	11542.32	11609.99
3	11438.06	11584.60	11391.59	11562.86
4	11393.24	11450.00	11382.21	11438.06

5. PERFORMANCE EVALUATION

In the world of digital financial markets, accurate bitcoin price forecast methodology is essential. A framework built on two different deep learning algorithms - LSTM and GRU is proposed in this study.

The performance is assessed for each epoch. With an early starting of 10, the current investigation applies 100 epochs. There are three different datasets: training, testing, and validation. The loss and evaluation functions are based on the mean squared error. The model performs better the lower the value.

$$MSE = \frac{1}{N}\sum_{i=1}^{N}\left(y_i - y_i^*\right)^2 \quad (1)$$

Three additional metrics, including Mean Absolute Percentage Error (MAPE), Root Mean Squared Error (RMSE), and Mean Absolute Error (MAE), are also used to assess different prediction algorithms.

$$RMSE = \sqrt{MSE} = \sqrt{\frac{1}{N}\sum_{i=1}^{N}\left(y_i - y_i^*\right)^2} \quad (2)$$

$$MAPE = \frac{1}{N}\sum_{i=1}^{N}\left|\frac{y_i - y_i^*}{y_i}\right| \quad (3)$$

$$MAE = \frac{1}{N}\sum_{i=1}^{N}\left|y_i - y_i^*\right| \quad (4)$$

where y_i is an actual value of an output, y_i' is the predicted value of an output and N is a total number of samples in dataset.

5.1 RESULTS

The following performance indicators were used to compare the outcomes of LSTM and GRU:

Table.3. Minimum Error Function Incurred During the Prediction

Measures	LSTM	GRU
MSE	0.00210	0.00029
RMSE	0.04582	0.01711
MAPE	0.10942	0.07036
MAE	0.03358	0.02214

The Table.3 shows minimum values of MSE, RMSE, MAPE and MAE for both LSTM and GRU.

Table.4. Maximum Error Function Incurred During the Prediction

Measures	LSTM	GRU
MSE	0.00793	0.00264
RMSE	0.08907	0.05136
MAPE	0.25511	0.21793
MAE	0.08577	0.07599

The Table.4 shows maximum values of MSE, RMSE, MAPE and MAE for both LSTM and GRU.

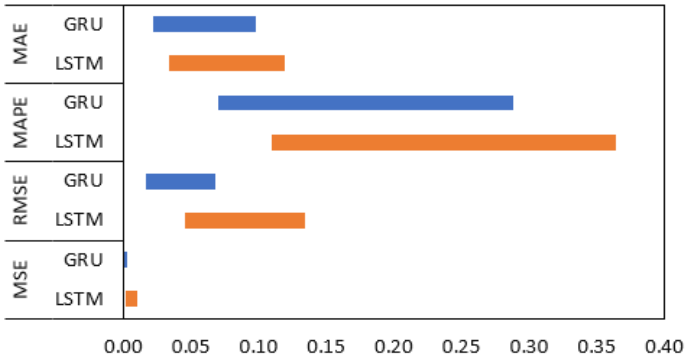

Fig.3. Error function comparison between LSTM and GRU

Based on these findings, the GRU model outperforms the LSTM algorithm in terms of accuracy and reliability in predicting cryptocurrency prices, but both algorithms produce excellent outcomes.

6. CONCLUSION

Since its debut in 2008, Bitcoin has recognized itself as a market leader in the cryptocurrency space. Millions of people use it worldwide, particularly in the United States. Cryptocurrency price predictions have become a hot issue, and we can profit from the arbitrage for investing. A framework built on two different deep learning algorithms - LSTM and GRU - was proposed in this study. The forecast from the Long Short-term Memory model may have a more extreme error, while the prediction from the GRU model is more accurate. Moreover, there is a connection between price movement and model precision. When compared to when there are fluctuations, the prediction is more accurate during the usual period. Additional market-influencing aspects will be looked into in upcoming research. Time series neural networks based on auto encoders will be used to make predictions based on the time-series data. Additionally, researchers can address how social media may have impact on the price and volume of crypto currency trade. Thus, in order to glean insights from posts and tweets, sentiment analysis and natural language processing techniques will be applied.

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