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Crytocurrency price prediction using machine learning

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Abstract

Cryptocurrencies are a digital way of money in which all transactions are held electronically. It is a soft currency which doesn't exist in the form of hard notes physically. Here, we are emphasizing the difference of fiat currency which is decentralized that without any third-party intervention all virtual currency users can get the services. However, getting services of these cryptocurrencies impacts on international relations and trade, due to its high price volatility. There are several virtual currencies such as bit-coin, ripple, ethereum, ethereum classic, lite coin, etc. In our study, we especially focused on a popular cryptocurrency, i.e., bitcoin. From many types of virtual currencies, bitcoin has a great acceptance by different bodies such as investors, researchers, traders, and policy-makers. To the best of our knowledge, our target is to implement the efficient deep learning-based prediction models. Specifically long short-term memory (LSTM) and gated recurrent unit (GRU) to handle the price volatility of bitcoin and to obtain high accuracy. Our study involves comparing these two time series deep learning techniques and proved the efficacy in forecasting the price of bitcoin.

Keywords: Bitcoin; Crytocurrency; Short-term memory (LSTM) and gated recurrent unit (GRU); Block chain

1. Introduction

Cryptocurrency is a term used to describe a virtual or digital currency used in financial systems. Encryption is used to safeguard it, preventing fraud and double spending. It also differs from conventional currencies in that it is a decentralised virtual money that can be converted via cryptographic methods and that it is not issued by a central bank or authority. Modern financial markets are characterized by a rapid flow of information. There is a huge number of transactions between market participants with different investment horizons. There are pension funds, for those time scale is years, and at the same time specialized algorithms operating at the level of seconds or even milliseconds (high-frequency trading). process now called the Wiener process. Later Benoît Mandelbrot's works turned out to be a groundbreaking achievement The market behaviour is the result of various influencing factors, ranging from economic data, results of companies, interventions of central banks, poll and referendum results, individual tweets of high-ranking people, and mutual interactions between participants. The first quantitative research on financial markets was the subject of Louis Bachelier's work [1], in which he derived a formula for option price based on cumulative distribution function (CDF) of a stochastic [2]. While examining cotton price fluctuations, he observed that, contrary to wide belief, their probability distribution function (PDF) is characterized by heavy, non-Gaussian tails. Mandelbrot was also the first to notice a fractal structure of stock price fluctuations. More than a quarter century ago, statistical physicists started their serious research in financial markets, which led to an outburst of a new discipline – econophysics [3, 4]. All cryptocurrencies exhibit high but slightly varying informational efficiency during both periods. Cardano was the most efficient cryptocurrency. These results might point to the increasing maturity and lower potential for price predictability, which matter to cryptocurrencies' usage for liquidity risk diversification strategy. Other cryptocurrencies like Ethereum, XRP, BNB, and Cardano have recently been the subject of investing and trading decisions, but there aren't

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many works on them. Given this context, investors and cryptocurrency traders gave this report the respect and market value it deserved. Additionally, several authors [5, 6] question the significance of the COVID-19 pandemic by looking at the hedging capabilities of cryptocurrencies. Therefore, it is important to examine how market efficiency has changed over time for these five cryptocurrencies, not only to add to the literature on the subject that focuses on Bitcoin but also to inform practitioners about how resilient cryptocurrency price efficiency is to major events like COVID-19. Investigating the disorder, predictability, and informational effectiveness of the daily closing prices of five main cryptocurrencies is important because the existence of price disorder and price predictability may matter (Bitcoin, BNB, Cardano, Ethereum, and XRP). To analyse the dynamic behaviour of cryptocurrency prices and the temporal evolution of efficiency surrounding the pandemic, the complete sample period (January 01, 2018, to December 31, 2021) is separated into two periods (before and during the COVID-19 epidemic). Taking into account the daily closing prices of five major cryptocurrencies (Bitcoin, BNB, Cardano, Ethereum, and XRP), this study investigates price disorder and market efficiency throughout three unique time periods: before and during COVID-19. Liu et al. [7-14] suggested deep reinforcement learning and proximal policy optimization (PPO) models for automatic Bitcoin trading based on our knowledge[15].SVM, multi-layer perceptrons (MLP), LSTM, temporal convolutional networks (TCN), and transformer are some examples of high-performing machine learning-based models for static price forecasts. According to simulation results, LSTM outperforms all other ML models tested in the work. Based on the policy, the authors developed an autonomous trading system employing PPO and LSTM. Experimental findings confirmed the proposed model's superiority to other conventional trading strategies. The ability of the suggested model to produce superior returns during both price gyrations and sudden price increases opens the door for study into the creation of a single deep learning-based cryptocurrency trading strategy. It provides impetus and demonstrates that the model may be expanded to other credit derivatives by illustrating how the model manages and controls increased transactions during the trading process. The ensemble learning methods for bitcoin forecasting utilising hourly prices were proposed by Livieris et al. [16].

2. Proposed system

Bitcoin is a worldwide and most popular cryptocurrency, first introduced in 2008and exploited as open source in 2009 by a person called Satoshi Nakamoto, butit became highly popular in 2017. Bitcoin functions as a decentralizedmoderateof electronic cash, with transactions proved and transcribed in a public distributedledger (blockchain) without any third-party intervention. Transaction blocks consistof secure shell algorithm which is used to connect each other, and blocks are servedas a non-editable data which is recorded when the transaction is being held. Then any virtual currency especially bitcoin has been adopted by the people, and the virtualcurrency market trend has been growing up.
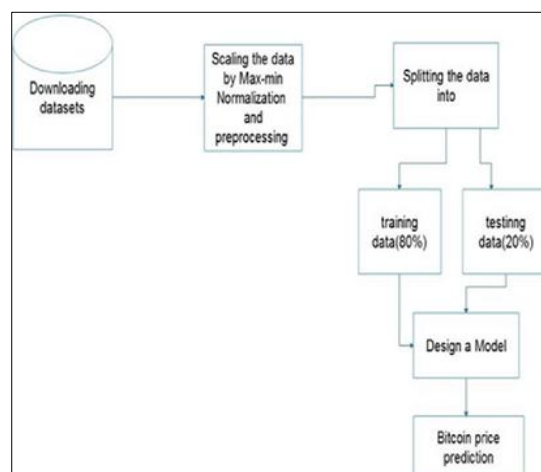
Figure 1 Architecture diagram

2.1. LSTM

In many ways, LSTMs are superior to RNN and traditional feed-forward neural networks. They have the ability to selectively remember patterns for extended periods of time, which explains this. This article's goal is to explain LSTM and show you how to apply it to practical issues.
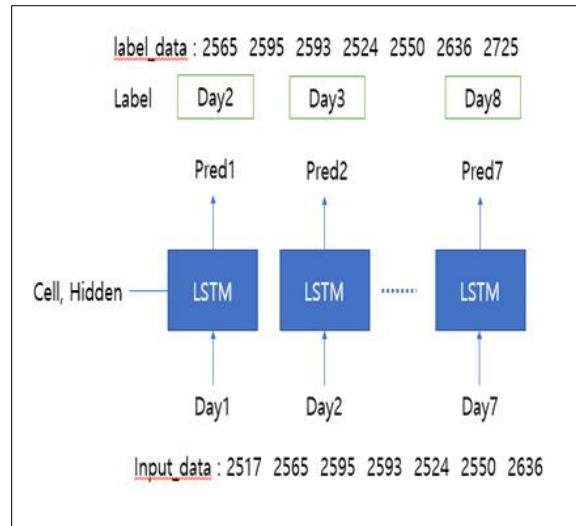
Figure 2 LSTM Diagram

2.2. GRU

The GRU is the newer generation of recurrent neural networks and is pretty similar to anLSTM. GRU got rid of the cell state and used the hidden state to transfer information. It has also only two gates, a reset gate and update gate.

2.2.1. Rest Gate

The reset gate is another gate that is used to decide how much past information to forget.

2.2.2. Update Gate

The update gate acts similar to the forget and input gate of an LSTM. It decides what information to throw away and what new information to be added.
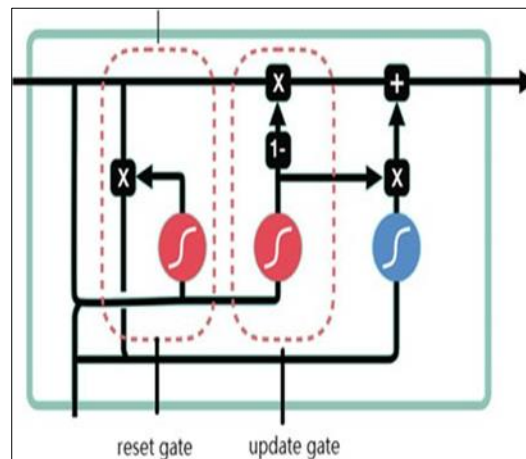
Figure 3 GRU diagram

3. Result and discussion

The proposed model of LSTM and GRU price prediction of bitcoin was trained, and the predictions were carried out for popular cryptocurrency. The accuracy of the proposed LSTM as well as GRU model is investigated by finding the

root mean square error (RMSE) and mean absolute percentage error (MAPE) to determine which model has better accuracy. We observed from the resultant Table that LSTM takes greater compilation time than GRU model.The MSE value obtained for 7 days ahead from both the models is plotted and it is clearly observed that GRU is converging faster and steady than the LSTM model. it is discovered that the variation of actual price and predicted price is more in LSTM than the GRU.

Figure 4 Command –Line Interface

Figure 4 shows, Create open-source packages can be installed. Anaconda Navigator, as a graphical alternative to the command-line interface (CLI).
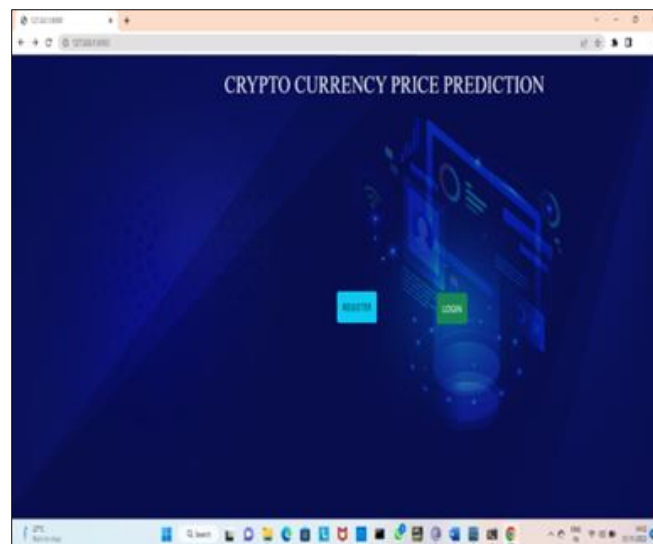
Figure 5 Price prediction

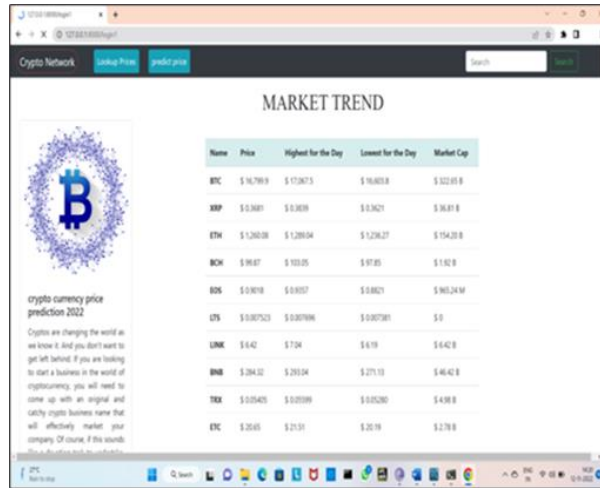Figure 5 shows, Register and login to the cryptocurrency price prediction

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Figure 6 Market Trend

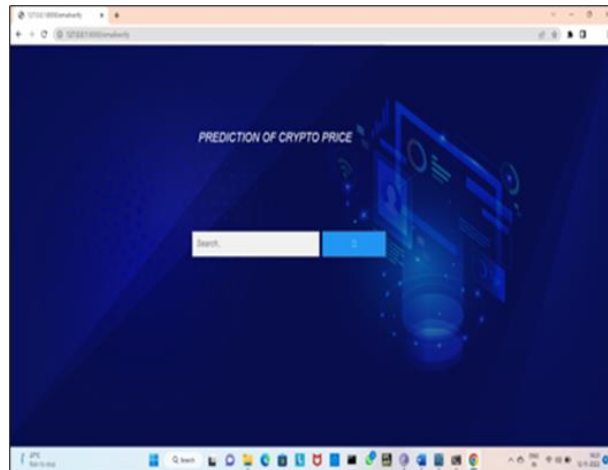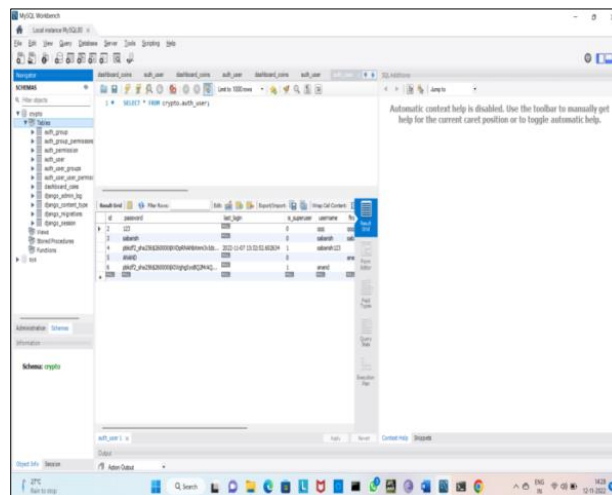Figure 6 shows, View the price prediction.

Figure 7 Crypto Price

Figure 7 shows, Prediction of crypto price.

Figure 8 ETH to USD

Figure 8 shows, The average price of ETH to USD for the past 60 days.

Figure 9 Price Predicted

Figure 9 shows, finally we have predicted.

4. Conclusion

Bitcoin is the most popular decentralized way of virtual currency which has a great role in the free market economy and avoids the intermediary of another third party between customers. The main objective of our study is to forecast the bitcoin price with improved efficiency using deep learning models and minimizing the risks for the investors as well as policy-makers. We have implemented two deep learning techniques such as LSTM and GRU as prediction models. The study reveals that the GRU model is the better mechanism for time series cryptocurrency price predictionand takes lower compilation time. LSTM and GRU models are more capable of recognizing long-term dependencies. In this study, we have only compared to basic deep learning-based models, i.e., LSTM and GRU. However, it needs to investigate further to enhance the accuracy of the deep learning-based prediction models by considering different parameters in addition to the previous one.

Future enhancement

Features such as political system, public relations, and market policy of a country can affect and determine the price volatility of cryptocurrency. In our study, we have not considered. Other cryptocurrencies such as ripple, ethereum, liteco in, and others. We will enhance the model by applying on these cryptocurrencies so the model becomes a stable one. Fuzzification can also be incorporated at the input layer by considering the degree of participation of each of the features in the prediction.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest.

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