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# Predicting Bitcoin Prices with Bi-LSTM Networks

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**ABSTRACT:** Cryptocurrency is a form of digital currency where all transactions are made electronically. It is a valuable resource and does not exist in the form of hard currency. Here we highlight the difference between fiat currency, which is decentralized and free of third-party intervention, and the service offered to all virtual currency users. However, access to cryptocurrencies can disrupt international relations and markets due to their volatile prices. There are many virtual currencies such as Bitcoin, Ripple, Ethereum, Ethereum Classic, Litecoin and more. In our research, we focus specifically on Bitcoin, a popular cryptocurrency. Among various virtual currencies, Bitcoin is widely accepted by many organizations, including investors, researchers, traders and policy makers. To the best of our knowledge, our goal is to make effective prediction models based on deep learning, especially Long Short Term Memory (LSTM) and Gated Recurrent Units (GRU), to control Bitcoin price change and achieve its accuracy. Our research involves comparing two real-time deep learning techniques and demonstrating their effectiveness in predicting Bitcoin price.

**KEYWORDS:** LSTM, GRU, Cryptocurrency, Bitcoin.

## I. INTRODUCTION

The digital cryptocurrency Bitcoin operates on an online decentralized network and does not rely on a government or legal system as it relies heavily on peer-to-peer network connectivity and cryptography to ensure integrity. This "trustless" system makes it easier to trade goods and services at lower costs. Since the market is new, existing studies on forecasting this market are limited. A study shows that Google Trends data and the number of Bitcoin-related tweets on Twitter correlate well with the price of Bitcoin and can therefore predict the value of Bitcoin. Another study used Bayesian regression (a binary distribution algorithm) to predict Bitcoin's price change, and when combined with trading strategies, the predictions were almost 200% better in less than 60 days. The study concludes that there may be "information" in Bitcoin's historical data that can help predict future price changes. Finally, recent research on Bitcoin price formation shows that macroeconomic and financial indicators will have little impact on Bitcoin price in the short term. Instead, market forces that affect Bitcoin supply and demand, particularly demand-side variables such as transaction volume, have a greater impact on Bitcoin price.

## II. LITERATURE SURVEY

1 - **Predicting Bitcoin Prices Using Machine Learning - Sean McNally, Jason Roche, Simon Caton - 2018 IEEE 26th European International Conference on Microparallel, Decentralized, Network Processing.** The purpose of this article is to determine the accuracy of the prediction of Bitcoin price movements in USD. Price data from Bitcoin Price Index. This work has been done with varying degrees of success using Bayesian optimized recurrent neural networks (RNN) and short-term temporal (LSTM) networks. The maximum classification of LSTM is 52% and RMSE is 8%. The popular time series forecasting ARIMA model was used for comparison with deep learning models. As expected, the non-deep learning method outperformed the non-linear ARIMA estimator. Finally, deep learning was measured on both GPU and CPU, and the learning time of the GPU was 67.7% faster than that of the CPU.

2 — **A new Bitcoin price prediction using LSTM — - Wu Chih — Hung, Ma Yu — Feng, Lu Chih — Jiang — 2018 IEEE International Data Research Workshop (ICDMW).**

Long short-term memory (LSTM) networks are the state-of-the-art in deep learning for time series prediction. However, less research has been applied to financial forecasts, especially cryptocurrency forecasts. Therefore, we propose a new LSTM model prediction framework that uses two different LSTM models (normal LSTM model and LSTM with ARIMA model) to predict the daily price of Bitcoin. The performance of the design was evaluated using daily Bitcoin price data for the period between January 1, 2018 and July 28, 2018, containing a total of 208 data points. The results confirm the best prediction of the ARIMA model measuring square footage. Error (MSE). Root Mean

Square Error (RMSE), Mean Absolute Percentage Error (MAPE) and Mean Absolute Error (MAE) are used for Bitcoin price prediction. The LSTM of our AR(2) model outperforms the traditional LSTM model. The contribution of this work is to provide a new prediction method for Bitcoin price prediction that can overcome and improve the problem of different input selection in LSTM without requiring precise information. The results reveal its potential use in various business cases, such as cryptocurrency prediction, medical data, or real-time financial data.

**3 — Scientific Research and Analysis of Data Mining Technology to Investigate Cryptocurrency Markets — - Akhilesh P. Patil, T.S. Akarsh, A. Parkavi — 3rd Sustainable Solutions 2018 International Conference on Computing Systems and Information Technologies (CSITSS).**

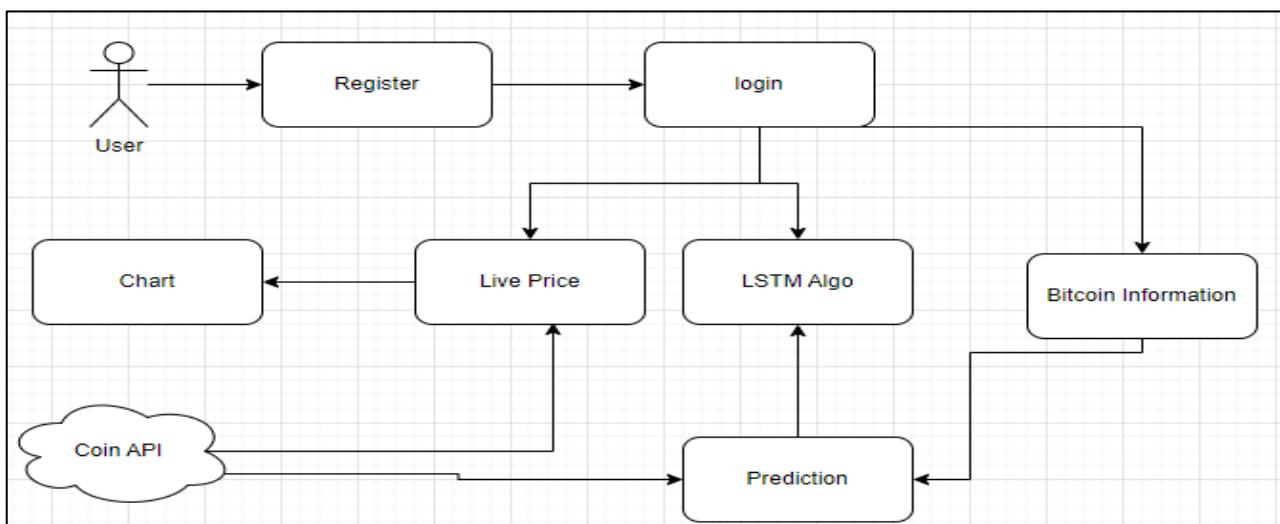
Bitcoin, Litecoin, Ethereum etc. The value of various cryptocurrencies such as is not always known. Therefore, it will be a big plus for investors if the model can predict the situation of the cryptocurrency market the next day. The time series model using the short-term memory network from this article is designed to determine the future value of cryptocurrency. According to the research, three cryptocurrencies were taken into account: Bitcoin, Litecoin and Ethereum. The results are compared using the concept of mining to explain the daily market sentiment of different currencies. The scores obtained by processing the words in the text are used as features in the model used for prediction. Time series plots were plotted using Plotly, a python library for plotting. The calculated mean error of the actual and predicted values is used as the uncertainty method. These uncertainty measures are compared to current market trends using theory mining.

**III. MODULE IDENTIFICATION**

1. User Registration and Login
  - a. User will register with his/her personal information. Data will be saved in database.
  - b. Once register user can login with emailed and password.
2. Realtime Price for Cryptocurrency
  - a. After login user can select different cryptocurrency to get real-time price.
3. Future Price Prediction
  - a. User can select different cryptocurrency to get the future price.
4. Basic Info of Cryptocurrency
  - a. User can select different cryptocurrency to get the information about cryptocurrency.

**IV. PROPOSED DESCRIPTION**

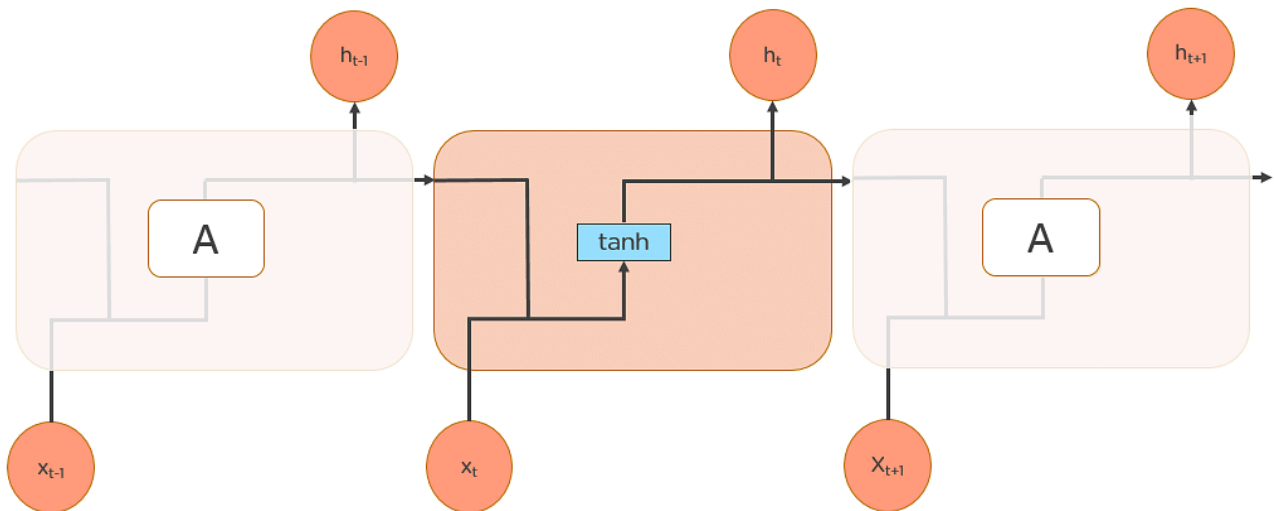
Today Bitcoin is a safe and profitable investment. These are allowed as a limit to how much customers can access their computers to record and record Bitcoin transactions. Trading of Bitcoins in different currencies is carried out in other offices, where "buy" or "sell" requests are placed in the order e-book. "Buy" or "bid" indicates the intention to purchase a particular measure of Bitcoin at a low price, while "bid" or "ask" indicates the expectation to bid a particular measure of Bitcoin at a certain price. This change is achieved by coordinating the requested price, from the preparation of e-books to the effective exchange between customers and suppliers.



### V. ALGORITHM

#### 1) Long Short-Term Memory (LSTM) Networks

LSTM is a type of RNN that is designed to handle the vanishing gradient problem that can occur in standard RNNs. It does this by introducing three gating mechanisms that control the flow of information through the network: the input gate, the forget gate, and the output gate. These gates allow the LSTM network to selectively remember or forget information from the input sequence, which makes it more effective for long-term dependencies.



#### 2) Step 1: Decide How Much Past Data It Should Remember

The first step in the LSTM is to decide which information should be omitted from the cell in that particular time step. The sigmoid function determines this. It looks at the previous state ( $h_{t-1}$ ) along with the current input  $x_t$  and computes the function.

$$f_t = \sigma (W_f \cdot [h_{t-1}, x_t] + b_f)$$

$f_t =$  forget gate  
Decides which information to delete that is not important from previous time step

Consider the following two sentences:

Let the output of  $h(t-1)$  be “Alice is good in Physics. John, on the other hand, is good at Chemistry.”

Let the current input at  $x(t)$  be “John plays football well. He told me yesterday over the phone that he had served as the captain of his college football team.”

The forget gate realizes there might be a change in context after encountering the first full stop. It compares with the current input sentence at  $x(t)$ . The next sentence talks about John, so the information on Alice is deleted. The position of the subject is vacated and assigned to John.

#### 3) Step 2: Decide How Much This Unit Adds to the Current State

In the second layer, there are two parts. One is the sigmoid function, and the other is the tanh function. In the sigmoid function, it decides which values to let through (0 or 1). tanh function gives weightage to the values which are passed, deciding their level of importance (-1 to 1).



$$i_t = \sigma (W_i \cdot [h_{t-1}, x_t] + b_i)$$

$$\tilde{C}_t = \tanh(W_C \cdot [h_{t-1}, x_t] + b_C)$$

$i_t$  = input gate  
Determines which information to let through based on its significance in the current time step

#### 4) Step 3: Decide What Part of the Current Cell State Makes It to the Output

The third step is to decide what the output will be. First, we run a sigmoid layer, which decides what parts of the cell state make it to the output. Then, we put the cell state through tanh to push the values to be between -1 and 1 and multiply it by the output of the sigmoid gate.

$$o_t = \sigma (W_o [h_{t-1}, x_t] + b_o)$$

$$h_t = o_t * \tanh (C_t)$$

$o_t$  = output gate  
Allows the passed in information to impact the output in the current time step

## VI. CONCLUSION

The LSTM model which we are going to implement here, is a basic model that takes into consideration all features that affect the Bitcoin price. We will try to create model which is accurate when predicting the future prices. However, to increase the efficiency of the model we will take live prices of bitcoin.

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