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Bitcoin Price Prediction Using Machine Learning Algorithm

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ABSTRACT: After the boom and bust of cryptocurrencies' prices in recent years, Bitcoin has been increasingly regarded as an investment asset. Because of its highly volatile nature, there is a need for good predictions on which to base investment decisions. Although existing studies have leveraged machine learning for more accurate Bitcoin price prediction, few have focused on the feasibility of applying different modelling techniques to samples with different data structures and dimensional features. More than 1500 crypto currencies are actively trading in today's scenario. The crypto currency can be generated and be used for online transactions. Bitcoin is a cryptocurrency technology. The value of Bitcoin keeps varying every second. Therefore, to predict the value of Bitcoin price here, we use the LSTM model and Keras TensorFlow Architecture. With the help of this architecture, we are trying to prove this architecture provides more accurate results than any other machine learning algorithms.

KEYWORDS: Cryptocurrency; Keras TensorFlow; Bitcoin; LSTM; Machine Learning;

I. INTRODUCTION

In 2017 due to repeated exponential growth in capital, the popularity for crypto currencies had taken uptrend. In the present scenario, there are more than 1,500 actively traded crypto currencies which capitalize over $300 billion, in Jan 2018 the market capital is totalling more than $800 billion. In between 2.9 and 5.8 millions of private investors and institutions in different networks, having access to market had become simple. Most of the crypto currencies are bought of online exchanges; also the volume of daily online exchanges is up to $15 billion. Due to the emerging of 170 hedge funds in crypto currencies, the Bitcoin future is having demand for trading and hedging Bitcoin. [1]

Bitcoin is a crypto currency used worldwide for digital payment or simply for investment purposes. Bitcoin is decentralized i.e. it is not owned by anyone. Transactions made by Bitcoins are easy asthey are not tied to any country. Investment can be done through various marketplaces known as "Bitcoin exchanges." These allow people to sell/buy Bitcoins using different currencies. The largest Bitcoin exchange is Mt Gox. Bitcoins are stored in a digital wallet which is basically like a virtual bank account. The record of all the transactions, the timestamp data is stored in a place called Blockchain. Each block contains a pointer to a previous block of data. The data on blockchain is encrypted. During transactions the users name is not revealed, but only their wallet ID is made public.[5]

Predicting the future is no easy task. Many have tried and many have failed. But many of us would want to know what will happen next and would go to great lengths to figure that out. Imagine the possibilities of knowing what will happen in the future! Imagine what you would have done back in 2012 when Bitcoin was less than $15 knowing that it would surpass $18,000. Many people may regret not buying Bitcoin back then but how were they supposed to k now in the first place? This is the dilemma we now face in regards to Cryptocurrency. We do not want to miss out on the next jump in price but we do not know when that will or will not happen. So how can we potentially solve this dilemma? Maybe machine learning can tell us the answer. [5]

Machine learning models can likely give us the insight we need to learn about the future of Cryptocurrency. It will not tell us the future but it might tell us the general trend and direction to expect the prices to move. We simply plan to use numerical historical data to train a recurrent neural network (RNN) to predict BTC prices. A recurrent neural network is a type of artificial neural network in which the connections are made between the nodes form the directed graphs along a temporal sequence. LSTM is an artificial RNN architecture which is used in deep learning which not only processes the single data points but the total data. [5]

II. RELATED WORK

In [2] authors used a machine learning techniques to predict a Bitcion price. The goal of this paper is to ascertain with what accuracy the direction of Bitcoin price in USD can be predicted. The price data is sourced from the Bitcoin Price Index. The task is achieved with varying degrees of success through the implementation of a Bayesian optimized recurrent neural network (RNN) and a Long Short-Term Memory (LSTM) network. The LSTM achieves the highest classification accuracy of 52% and a RMSE of 8%. The popular ARIMA model for time series forecasting is implemented as a comparison to the deep learning models. As expected, the non-linear deep learning methods outperform the ARIMA forecast which performs poorly. Finally, both deep learning models are benchmarked on both a GPU and a CPU with the training time on the GPU outperforming the CPU implementation by 67.7%.

In [3] authors proposed a new forecasting framework with LSTM model to forecasting Bitcoin daily price. Long short-term memory (LSTM) networks are a state-of-the-art sequence learning in deep learning for time series forecasting. However, less study applied to financial time series forecasting especially in cryptocurrency prediction. Therefore, we propose a new forecasting framework with LSTM model to forecasting Bitcoin daily price with two various LSTM models (conventional LSTM model and LSTM with ARIMA model. The performance of the proposed models are evaluated using daily Bitcoin price data during 2018/1/1 to 2018/7/28 in total 208 records. The results confirmed the excellent forecasting accuracy of the proposed model with ARIMA. The test mean squared error (MSE), root mean square error (RMSE), mean absolute percentage error (MAPE), and mean absolute error (MAE) for Bitcoin price prediction, respectively.

In [4] authors used Opinion Mining and Data Mining Techniques to Analyze the Cryptocurrency Market. The value of various Cryptocurrencies such as Bitcoin, Litecoin, and Ethereum are always elusive. Hence, it would be a great value addition to investors if a model is able to predict what would be the nature of the crypto market for the next day. Through this paper, atime-series model using Long Short-Term Memory Networks is built to determine the value of cryptocurrency in the future. As a study, three cryptocurrencies - Bitcoin, Litecoin and Ethereum has been taken into consideration. A comparison of the results by using opinion mining to interpret the mood of the market on the current day for different currencies has been done. The time-series charts are plotted using Plotly - python library for graphing plots. The Mean Absolute Error calculated between the actual and predicted values is used as the uncertainty quantification method.

In [5] a comparison between Multi-Layer Perceptron (MLP) and Non-linear autoregressive exogenous (NARX) model is made. They conclude that MLP can also be used for stock market prediction even though it does not outperform NARX model in price prediction. The authors made use of MATLAB's neural network toolbox to build and evaluate the performance of the network.

III. PROPOSED ALGORITHM

A. *Design Consideration*

- TensorFlow GPU
- Keras
- Python 3.7
- Google Colaboratory

B. *Description of the Proposed Algorithm:*

The structure of RNN and LSTM models for Bitcoin price prediction is shown in Fig 1.To exploit the temporal relationship, both RNN and LSTM models use an internal state (memory).
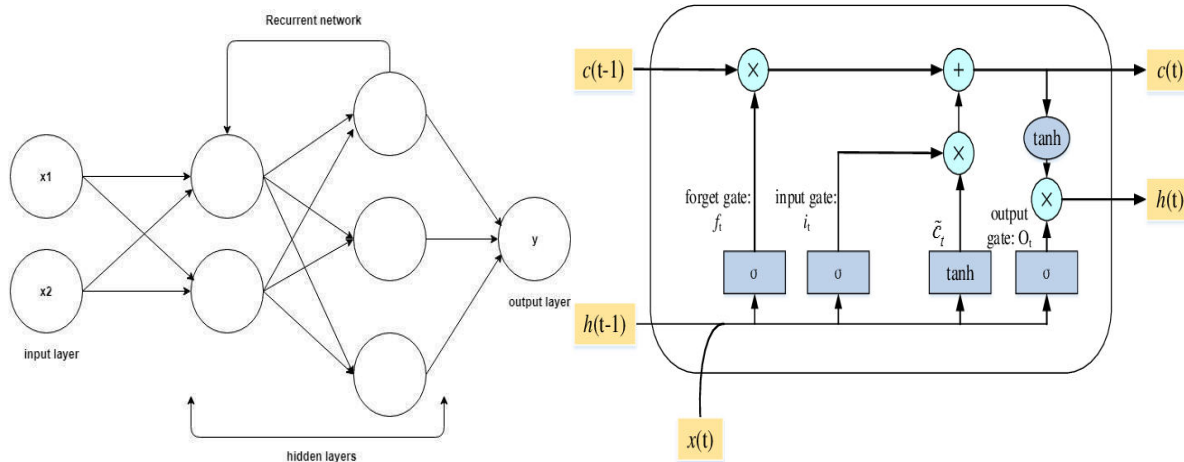
Fig 1: Recurrent neural network model (left) and long short-term memory model (right).

To illustrate, suppose that we use three days data to predict the price. Then, the input layer of anRNN model consists of three nodes each of which takes the whole data of a single day, i.e., a vector of 18 features. Given xtas an input, each hidden state htis then computed as follows:

$$h_t = \tanh(W_h x_t + U_h h_{t-1} + b_h)$$

where Wh , Uh, and bh are parameters to be learned and tanh is a hyperbolic tangent function. The main difference from DNNs is that RNNs use not only the input xt, but also the previous hidden state ht−1, to compute the current hidden state ht, thus exploiting the temporal dependency between the input sequence data. Assuming that we use three days sequence data, the final output y for regressionis computed as follows,

$$y = w_y h_3 + b_y$$

where wy and by are also parameters to be learned.

IV. PSEUDO CODE

STEP 1: Load Yahoo Finance Dataset.
STEP 2: Configure the TenserFlow GPU.
STEP 3: PREPROCESS the yahoo finance data by use of pandas dataframe.
STEP 4: Construct keras tensorflow architecture
STEP 5: Train the keras tensorflow model
STEP 6: Test and predict the Bitcoin Price.

V. SIMULATION RESULTS

Neural networks provided a better understanding of Bitcoin and LSTM architecture. This architecture works efficiently and provides us with the most accurate results. Here we have taken data which is sorted by time and recorded at equal intervals i.e. time series data. Here we use special class of neural network model known as LSTM Recurrent Neural Network which allows using the output from model as a new input for the same model. Below is the graph which analyzes the actual price and predicted price of Bitcoins.

Fig 2: Bitcoin Price Prediction

VI. CONCLUSION AND FUTURE WORK

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 machine learning models and minimizing the risks for the investors as well as policy-makers. We have implemented deep learning techniques such as LSTM and RNN as prediction models. The study reveals that this model is the better mechanism for time series cryptocurrency price prediction. Because of the usage of this algorithm, we can save a large amount of data and predict the most accurate results. In our study, we have not considered other cryptocurrencies such as ripple, ethereum, litecoin, and others. In future we will analyze the correlation between these cryptocurrencies and how would it affect the performance of our model. We will enhance the model by applying on these cryptocurrencies so the model becomes a stable one.

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