INTERNSHIP REPORT

**ON**

# BIT COIN PREDICTION USING RNN AND LSTM NETWORKS

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SUBMITTED

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# ABSTRACT:

In this article, we offer a method for reliably predicting the Bitcoin price by taking into account a variety of factors that influence its value. We discovered the benefits and drawbacks of bitcoin price prediction by gathering information from many reference papers and implementing it in real time.
Each study has its own set of techniques for predicting bitcoin prices. Many publications have accurate prices, while others do not; nevertheless, the time complexity of such forecasts is greater; thus, to minimise the time complexity in this study, we apply an artificial intelligence-based method called RNN and LSTM. This survey study will assist aspiring researchers in making an impression in their articles. We seek to comprehend and uncover everyday patterns in the Bitcoin market while getting insight into ideal characteristics surrounding Bitcoin pricing in the paper, which is the initial moment of the research.



**KEYWORDS**: RNN, LSTM, Bitcoin, cryptocurrency, Model, price,


# CHAPTER 1: INTRODUCTION:

Bitcoin is a digital currency that is used for advanced payments and speculative reasons all over the world. Bitcoin is decentralised in the sense that it is not owned by anybody. Bitcoin exchanges are easy since they are not tied to any country. Speculation should be available through several "bitcoin transactions," or commercial hubs. These allow people to sell and buy Bitcoins with a variety of other currencies. Mt Gox is the largest Bitcoin exchange. Bitcoins are stored in a sophisticated wallet, which functions similarly to a virtual bank account.

The timestamp information and the record of a large number of transactions are stored in a place called Block chain. A square is the name given to each record in a block chain. Each square includes a link to a previous information square. The data on the block chain has been jumbled. During exchanges, the client's identity isn't revealed; just their wallet ID is revealed. The value of Bitcoin swings similarly to that of a stock, but in an unexpected fashion. For value forecasting, several calculations are used to financial exchange data.

Nonetheless, the variables that influence Bitcoin are exceptional. In this way, it's critical to forecast Bitcoin's value so that the best business decisions can be made.
Unlike stock exchanges, the price of Bitcoin does not depend on business events or a middleman government. As a result, we believe it is critical to apply AI innovation to forecast the price of Bitcoin in order to predict its value.

Bitcoin is the first digital decentralised cryptocurrency to experience a major market value increase in recent years. The goal of this study is to use machine learning techniques and sentiment analysis to determine the Bitcoin price direction in USD that is predictable. Researchers are studying public sentiment on Twitter and Reddit. We analysed the link

between bitcoin price fluctuations and attitudes in tweets using sentiment analysis and supervised machine learning concepts applied to the collected tweets from Twitter and Reddit postings. We used supervised learning to investigate numerous machine learning techniques in order to construct a prediction model and provide useful information on future market prices. It is frequently difficult to make proper forecasts due to the complexity of determining the exact nature of a Time Series (ARIMA) model. Then, with long short-term memory cells, we continue to use Recurrent Neural Networks (RNN) (LSTM). We compared the predictability of bitcoin price and sentiment analysis of bitcoin tweets to the usual method and assessed the time series model prediction of bitcoin prices with improved efficiency using long short-term memory (LSTM) techniques (ARIMA).

## 1.1: HISTORY OF BITCOIN

Finance, like most human inventions, is constantly evolving. It started with basic food being traded for livestock, and livestock for resources like wood, or maize. It progressed to precious metal, such as silver and gold. And now, the next step in financial evolution has come to light.

Bitcoin isn't based on silver or gold - it's based on mathematical proofs validated by a public ledger called blockchain technology. Bitcoin is generated through a complex sequence of mathematical formulas that run on computers; the network shares a public ledger using blockchain technologies that record, and validate, every transaction processed.
A single institution, such as the government, does not control the Bitcoin network. The idea behind the technology has always been - and remains - one of decentralization - that is, remaining completely independent of a central authority.

Bitcoin includes a scripting language that can be used to build more expressive "smart contracts," basically cryptographically-locked boxes that can be opened if certain conditions are verified. In addition, transactions can store arbitrary data via the OP _RETURN mechanism. (https://ieeexplore.ieee.org/abstract/document/7961975)
Virtual money has come into vogue at different times during the history of sedentary human civilization, and has often stayed for extended periods of time before being replaced by 'tangible' money alternatives, only to be superseded by virtual money in what has been described as a series of long-cycles of money instruments and debt (Graeber 2011)

## 1.2: BIT COINS SCOPE IN PRESENT DAY

It's worth noting that in India, there is no law prohibiting the use of cryptocurrency. Cryptocurrency ownership and trading are completely legal. There had been a ban on banking companies not supporting cryptocurrencies, but there is currently no regulatory or legal structure governing cryptocurrency. It's also worth noting that it's not legal tender. Section 26 of the Reserve Bank of India Act 1934 states that legal money is "assured by the central

government of India." To make cryptocurrencies legal tender, the government must publish a notice in the official gazette, but it cannot be legally enforced until then.

## 1.3: BITCOIN'S IMPACT ON THE INDIA MARKET

In the current digital era, when technology has played a critical part in reshaping the global digital economy, India is taking baby steps toward adopting digital currencies like Bitcoins.
In India, the entire Bitcoin turnover is projected to be over Rs 300 crore, with a user base of around 1,00,000 people. We're on our approach to finding a planet where transactions between user ends can be done digitally rather than the old-fashioned way. These transactions are validated by network nodes and published in the Blockchain, a public distributed database that empowers Bitcoin as its unit of account. It's nothing more than a clever technique to cross borders and try out a new and fast approach to handle your day-to-day financial activities.

bitcoin market is imagining itself as a massive market place where Bitcoin and Blockchain technology can successfully extend their wings and fly high to their destination. Like the internet, a financial infrastructure based on Bitcoin and its underlying technology Blockchain is expected to usher in a revolution. It demonstrates that individuals not only want to access the internet, but also want to do it on their smartphones. Around 50,000 people in India are interested in Bitcoin, with 30,000 of them actually owning the money. Bitcoins are swiftly transitioning from trading units to purchasing currency; some of the most popular BTC exchanges include Binance, Coinbase Pro, and Okex**.**

**Statistics on the Bitcoin price**

Today's Bitcoin price (date: September 29, 2021) Bitcoin
price:$42,458.08.

The value of one Bitcoin in 2011 was 5 $. And now it has sky rocketed. If one had invested a 100$ then now would have been a millionaire.

# CHAPTER 2: RELATED WORKS

## 2.1: CHALLENGES FACED FOR BITCOIN

• **Volatility**

Bitcoin has been incredibly volatile since it was created. Experts predict that the price of BTC coins might reach as high as a million in a few years, and some say that it might even go to zero. This environment has made Bitcoin extremely popular among investors who bilevel that the price may rise even more, but it some fall significantly.

• **Cybertheft**

There are several standards in place to make BTC nearly impossible to steal, but taking advantage of this system necessitates a thorough understanding of the Bitcoin operating system as well as a large amount of effort on the part of the user. In reality, several reports claim that buyers lose money on exchanges and through mining losses.

• **Tax issues**

BTC is now classified as intangible property under the law, which means it is liable to capital gains taxes. If an investor purchases Bitcoin and later sells it for a higher price, they must show the difference in taxes. It will be a taxable event each time an investor purchase something with BTC.

• **Capacity for expansion**

Bitcoin is based on the blockchain technology, which limits the amount of data that may be stored in each block to one megabyte. The network capacity is limited to three transactions per second because of this restriction. As more transactions are completed, the network will have a harder time keeping up with the records, resulting in significant processing delays.

• **Inability to self-regulate**

It is impossible to manage Bitcoin's market behaviour merely based on financial incentives due to its lack of accountability. This leads to a slew of issues, including smart contracts and other market hacks, scammers creating phoney crowdfunding investments and then fleeing with the money, and other related effects. Buyers will quickly lose faith in bitcoin if it cannot be regulated internally.

## 2.2: BITCOIN AS PAYMENT SYSTEM

Bitcoin claims to be a retail payment system that does not require the use of trusted intermediaries. Later are seen to change exorbitant rates for payment transmission, a lack of effective protection of personal and financial data, and to expose customers to financial risk by being vulnerable to financial crises. Another crucial point is whether or not bitcoin users are at risk. Bitcoin is a digital currency that does not eliminate financial or risk for customers, but rather transfers ownership to the person. The bitcoin system's efforts to safeguard the payment system's integrity are focused on counterfeit detection and security anonymity**.** Bitcoin attempt to digitally mimic cash in terms of anonymity, payment finality, transaction costs and decentralised operation transfer.

Calculation using blockchain data. Transaction fees account for less than 1% of a miner's revenue, according to data. Successful miners are currently rewarded with 12.5 percent freshly created bitcoins; however, this percentage will drop to around 0.78 bitcoins in the year 2032.

## 2.3: TIMELINE OF EVENTS

Legends say that Satoshi Nakamoto began working on the concept of bitcoin in 2007. Who this person really is, is not known? It is speculated that Nakamoto can be pseudonym for more than one person. However even with the confusion it has grown over the years maintained by a collective group of brightest minds in technology.

On August 18, 2008, an unknown person or entity registered the Bitcoin.org domain. The domain was registered at anonymosspeech.com, a site that allows users to anonymously register domain names and currently accepts Bitcoin. It was on October 31st, 2008, "Bitcoin: A Peer-to-Peer Electronic Cash System" was posted to a cryptography mailing list, published under the name "Satoshi Nakamoto". The mailing list was named as metzdowd.com. The white-paper outlined the foundation of how Bitcoin would operate and solves the problem of double spending so as to prevent the currency from being copied.

November 9 2008, the bitcoin project gets registered on sourceforge.net which is a community collaboration website focussed on development and distribution of open-source software

On January 8th, 2009, the first version of Bitcoin is announced, and shortly thereafter, Bitcoin mining begins. On January 9, 2009, version 0.1 of bitcoin is released compiled with Microsoft Visual studio for Windows. It lacks a command line interface and is only that much completed that it increases the speculation that bitcoin in first place was developed by more than one person or by and academic person with little physical programming experience but a great deal of theoretical knowledge. This program included a bitcoin generation system which could create about 21 million bitcoins through the year 2040.
It was on January 12th 2009, that the first transaction of Bitcoin takes place, between Satoshi and Hal Finey and in December 16 , 2009, Version 0.2 of Bitcoin got released. On February 6, 2010, Bitcoing gets established by dwdollar as a currency exchange is born. On February 18, 2010, the encryption patent application filed by Neal Kin, Vladimir Oksman and Charles Bry on August 15, 2008 was published.

A Version 0.3 was released on July 7, 2010, and in July 11, 2010, large number of bitcoin users are introduced when mention of version 0.3 is done in Slashdot. All this increase in bitcoin user, rose the bitcoin value tenfold on the very next day.
A vulnerability in bitcoin market caused bitcoins to be improperly verified and exploited resulting in generation-of 184 billion bitcoins on August 15, 2010. On July 26, 2011, Poland based Bitomat, the third largest bitcoin exchange loses 17000 bitcoins.
By 2012, the global bitcoin payment service BitPay reported that 1000+ merchants were accepting Bitcoin under its payment processing service. In 2013, Coinbase, another payment processor, announced that it had sold $1 million (USD) worth of bitcoins in one month, at per unit equivalent above $22 per bitcoin. (A History of Bitcoin 30th September, 2017 1 Usman W. Chohan, MBA School of Business and Economics University of New South Wales, Canberra)
By 2015, the number of merchants worldwide had swollen to an estimated 160,000 merchants. The value of bitcoin, meanwhile has continued to soar, albeit with sharp volatility (see also Chohan 2017d, 2017e). On 20 May 2017, the price of one bitcoin passed US$2,000 for the first time, rising to $3000 on 5 August, and then to $4000 on 12 August. Bitcoin has split into two trading instruments as well: bitcoin classic (BTC) and bitcoin cash (BCH). Bitcoin twitter account bio reads as: "Bitcoin is an open-source censorship - resistant peer - to - peer immutable network. Trackable digital gold. Don't trust; verify. Not your keys; not your coins".

Bitcoin just went on progressing after this with increased speed. Today Bitcoin is traded by various people in all houses. It has a given richer exploration in the field of finance.

# 3. SYSTEM ARCHITECTURE

## 3.1: TECHNOLOGIES USED

### 3.1.1: Recurrent Neural Networks

RNNs are a form of neural network that is both durable and strong, and they are regarded as one of the most professional algorithms because they are the only ones with internal memory. Recurrent neural networks were initially developed in the 1980s, but their full potential has only recently been recognised. RNNs have risen to prominence due to increases in processing power, as well as the massive amounts of data we now have to deal with and the discovery of short-term memory (LSTM) in the 1990s.

For sequential data such as time series, voice, text, financial data, audio, video, weather, and more, the algorithm performs admirably. In comparison to other algorithms, RNNs are capable of forming a considerably deeper knowledge of a sequence and its context.

The information in an RNN travels through a cycle. When making a decision, it takes into account the current input as well as what it has learnt from prior inputs.

The flow of information in the RNN algorithm is seen in the figure below.

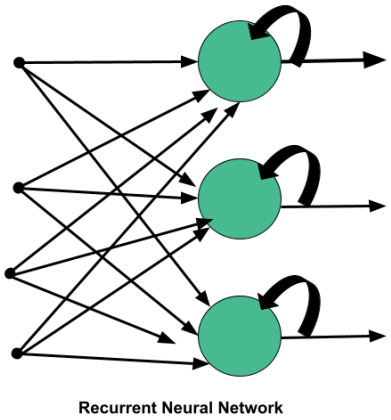



Fig (1): Recurrent Neural Network

### 3.1.2 Long Short-Term Memory (LSTM)

Long short-term memory networks are a type of recurrent neural network that essentially extends memory. As a result, it is ideally adapted to learning from significant events separated by extended periods of time.

RNNs can recall inputs for a long time because to LSTMs. This is due to the fact that LSTMs store information in a memory similar to that of a computer. The LSTM has the ability to read, write, and erase data from its memory.

There are three gates in an LSTM: input, forget, and output. These gates decide whether fresh input should be allowed (input gate), whether it should be deleted because it isn't significant (forget gate), or whether it should have an influence on the output at the current timestep (impact gate) (output gate). The three gates of an RNN are depicted in the diagram below:

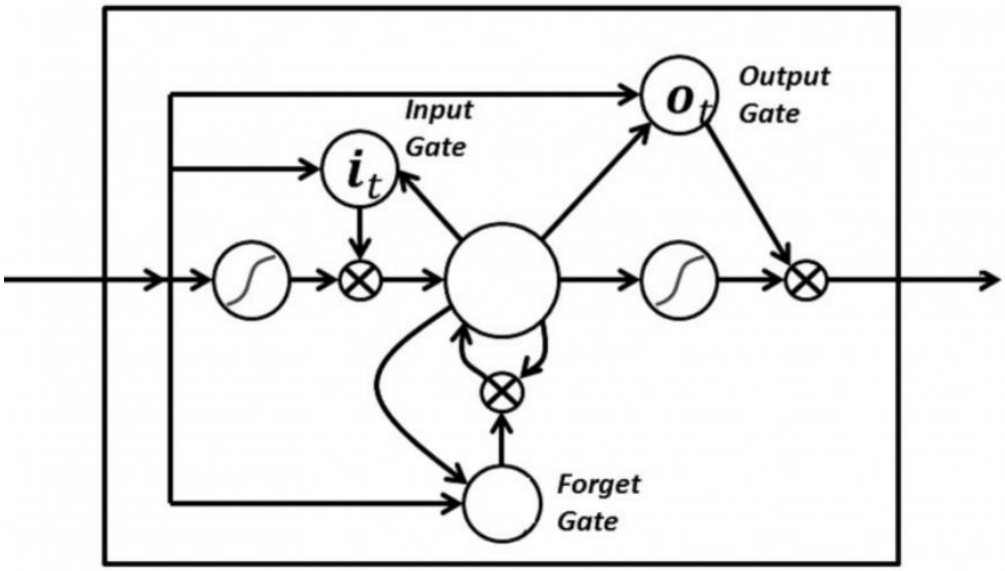



Fig (2):LSTM's Gate

An LSTM's gates are analogue in the form of sigmoid, which means they range from zero to one. Because they are analogue, they may do backpropagation.

## 3.2: WHAT TOOLS WE'LL BE USING

For this exercise, I'm using Numpy and Pandas to deal with the data and Keras/TenserFlow for the machine learning functions. For debugging and its ability to present code nicely I use Google colab.

The data is collected the current data for Bitcoin from Quant Masters. The Data was given to us by the trainer.

## 3.2.2: DATA PREPARATION

First, we start by importing all of the required packages, loading the dataset and removing the rows we are not interested in using.We split the dataset up into a training and test set, and

standardise its features. Standardisation is good practice as it reduces overfitting in cases where variance for some features may be higher than others.

The LSTM model requires us to organise the data in blocks. Our data is grouped at one-minute intervals and we'll use blocks of 50 minutes to predict the next block.

## 3.2.3: THE MODEL

Now it's time to train our model. We choose what type of model we want to use; sequential in this case, and we decide our hyper-parameters. We use the mean-squared-error loss function, the Adam optimiser, set the batch size at 128, and go through this network for 30 epochs.

Deciding on hyper-parameters is more art than science, and it's worth testing out multiple options to understand what works best on your test data and in production.

```
import keras_tuner as kt
from tensorflow.keras.layers import LSTM
from tensorflow.keras.layers import Dense

def model_builder(hp):
    model = Sequential()
    model.add(LSTM(hp.Int('input_unit',min_value=32,max_value=512,step=32), return_sequences=True, input_shape= ( trainX.shape[1], trainX.shape[2])))
    for i in range(hp.Int('n_layers', 1, 4)):
        model.add(LSTM(hp.Int(f'lstm_{i}_units',min_value=32,max_value=512,step=32),return_sequences=True))
    model.add(LSTM(hp.Int('layer_2_neurons',min_value=32,max_value=512,step=32)))
    model.add(Dropout(hp.Float('Dropout_rate',min_value=0,max_value=0.5,step=0.05)))
    model.add(Dense(30, activation=hp.Choice('dense_activation',values=['relu', 'sigmoid'],default='relu')))
    model.add(Dropout(hp.Float('Dropout_rate',min_value=0,max_value=0.5,step=0.05)))
    model.add(Dense(1, activation=hp.Choice('dense_activation',values=['relu', 'sigmoid'],default='relu')))

    model.compile(loss='mean_squared_error', optimizer='adam',metrics = ['mse'])

    return model

tuner = kt.RandomSearch(model_builder, objective="mse", max_trials = 3, executions_per_trial =1,directory = "./")

tuner.search(x=trainX, y=trainY, epochs = 150, batch_size =128, validation_data=(testX, testY), shuffle=False)
```

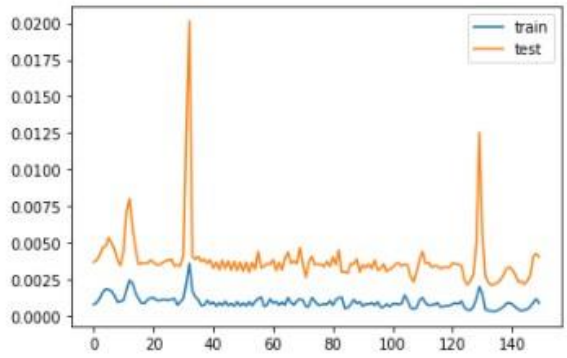
```
Trial 3 Complete [00h 21m 25s]
mse: 0.07578345388174057

Best mse So Far: 0.0007344374898821115
Total elapsed time: 01h 07m 27s
INFO:tensorflow:Oracle triggered exit
```

Fig(3): Keras Tuner details

Predict the price of cryptocurrency using LSTM neural network (deep learning) This is the model-building stage. Finding the right model is an art, and it will take several tweaks and attempts to find the right layers and hyperparameters for each one.

```
plt.plot(history.history['loss'], label='train')
plt.plot(history.history['val_loss'], label='test')
plt.legend()
plt.show()
```




Fig(4): Train and test result graph

The model building is quite simple and standard for this type of problem.

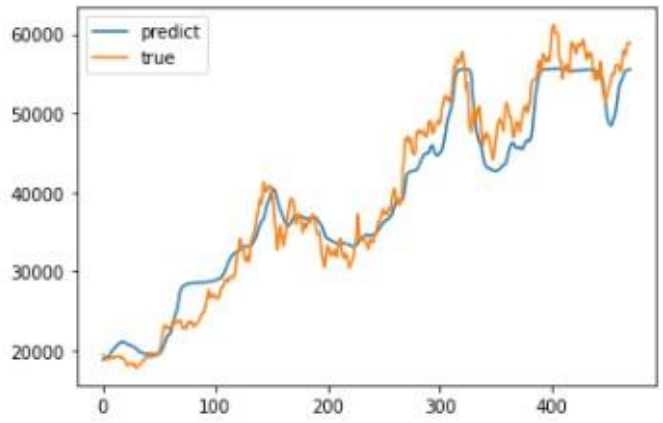
```
tuner.results_summary()
```

```
Results summary
Results in ./untitled_project
Showing 10 best trials
Objective(name='mse', direction='min')
Trial summary
Hyperparameters:
input_unit: 352
n_layers: 3
lstm_0_units: 192
layer_2_neurons: 224
Dropout_rate: 0.05
dense_activation: sigmoid
lstm_1_units: 32
lstm_2_units: 32
Score: 0.0007344374898821115
Trial summary
Hyperparameters:
input_unit: 416
n_layers: 2
lstm_0_units: 448
layer_2_neurons: 480
Dropout_rate: 0.45
dense_activation: relu
lstm_1_units: 384
lstm_2_units: 384
Score: 0.07578345388174057
Trial summary
Hyperparameters:
input_unit: 224
n_layers: 4
lstm_0_units: 416
layer_2_neurons: 128
Dropout_rate: 0.45
dense_activation: relu
lstm_1_units: 288
lstm_2_units: 288
lstm_3_units: 32
Score: 0.07578345388174057
```

Fig(5): Tuner's Result Summary

Training this model is something you can do even without a GPU, the amount of data is very low and the network architecture is very simple. When it comes to more advanced models with more granular information, it can take hours or days to train.

```
plt.plot(predicted_BTC_price, label='predict')
plt.plot(true, label='true')
plt.legend()
plt.show()
```




Fig(6): Actual prediction vs the true value graph

# CHAPTER 4: RESULT AND CONCLUSION

RNNs and LSTM are excellent technologies and have great architectures that can be used to analyse and predict time-series information. The focus of the article was to implement a simple model, if you are interested in the subject, try different things and want to play with hyperparameters and layers.

Tools such as the LSTM model and others are becoming more accessible every day, with large groups and institutions pushing the boundaries of what these models can do through better data and superior processing capacity. This leads to markets integrating ever increasing amounts of information into asset prices — making arbitrage opportunities rare.

# CHAPTER 5: REFERENCES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