

CRYPTOCURRENCY PRICE DETECTION USING MACHINE LEARNING

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ABSTRACT

Cryptocurrency represent valuable and intangible objects which are used electronically in different applications and networks such as virtual worlds and peer to peer networks. The use of virtual currency has become widespread in many different systems in recent years. Based on the fact that many users follow the conventional method of investing in any stock or cryptocurrency, we aim to provide the investor with the knowledge to buy a digital currency based on its past trends using machine learning algorithms.

KEYWORDS

Cryptocurrency, Bitcoin, LSTM (Long-Short Term Memory), Machine Learning, Normalizing, Linear Regression, Data Analysis, Recurrent Neural Networks (RNN), Keras, Numpy, Pandas, Cryptocurrency in India, Investment, Blockchain, Data Mining, Currency, Litecoins

INTRODUCTION

Investment firms, hedge funds and even individuals have been using financial models to better understand market behaviour and make profitable investments and trades. A wealth of information is available in the form of historical currency prices and performance data, suitable for machine learning algorithms to process. Can we actually predict crypto currency prices with machine learning? Investors make educated guesses by analysing data. They'll read the news, study the history, trends and other lots of data points that go into making a prediction. The prevailing theories are that crypto currency prices are totally random and unpredictable. About 70% of all orders on Wall Street are now placed by software; we're now living in the age of the algorithm. This project seeks to utilize Deep Learning models, Long-Short Term Memory (LSTM) Neural Network algorithm, to predict crypto currency prices. For data with timeframes recurrent neural networks (RNNs) come in handy but recent researches have shown that LSTM, networks are the most popular and useful variants of RNNs. We will use Keras to build a LSTM to predict crypto currency prices using historical closing price and trading volume and visualize both the predicted price values over time and the optimal parameters for the model.

LITERATURE SURVEY

Shailak Jani (2018) in his research paper, **The Growth of Cryptocurrency in India: Its Challenges & Potential Impacts on Legislation**^[1] talks about users' confidence of dealing with cryptocurrency while any monetary transactions and also user's expectations for the future of cryptocurrency. He put emphasis over security threats, collapse concerns in cryptocurrency systems, impact on real monetary systems, fluctuation in virtual currency value etc. At the end of his paper he concluded that cryptocurrency offers a new, effective and attractive model of payment methods that can boost companies and operators revenues. It also provide alternative method of payment, apart from real money, that enable users to make financial activities such as buying, selling, transferring and exchanging easily.

Swati Shukla, Akshay. A (2019) in their research paper **A Study on The Awareness and Perception of Cryptocurrency in Bangalore**^[4] found some interesting data regarding cryptocurrency perception among the people of Bangalore. They found that about 75% of the respondents are aware about cryptocurrency where most of the respondents fall in the age category of 30-40, majority have master degree and earn more than 10 lakh per annum. Majority of the respondents want cryptocurrency to be regularized as an investment tool and majority of respondents that have already invested in cryptocurrency majority got 5% of return followed by more than 10% on return on investment in cryptocurrency.

Mr.J.P.Jaideep, , Mr. K.Rao Prashanth Jyoty (2019) in their research paper "**A Study on Cryptocurrency in India – Boon or Bane**"^[3] concluded the exploratory research on the role of bitcoin and its future in the Indian economy. according to them bitcoin will predominantly have negative impact to the country but it may have a positive impact for the citizens of India who are rational and have individualistic consumer pattern behavior. it can be inferred that cryptocurrency has its own drawbacks but also have a positive impact in uplifting the one's wealth. They served an outcome by stating- "this will help India to reach to the next platform of e-commerce. Indians are to be benefited by bitcoin, but it may not be the same for the nation as the whole".

In Bitcoin and Cryptocurrency: Challenges, Opportunities and Future Works^[2], the authors said that cryptocurrencies are here to stay. According to them users

and industry player can evaluate whether cryptocurrency can benefit or harm them, in accordance with their objectives and perspectives in owning it. The paper calls for more in depth studies on several aspects of cryptocurrency and blockchain technology. They say that cryptocurrency and blockchain technology can be beneficial for researchers and application in using cryptocurrency to the best of its ability will be one of the most prominent discoveries of the 21st century.

PROPOSED ARCHITECTURE

1. Collection of all historical data
2. Finding features affecting current price of the currency
3. Normalizing data / data cleaning
4. Training the model
5. Predicting values and measuring accuracy

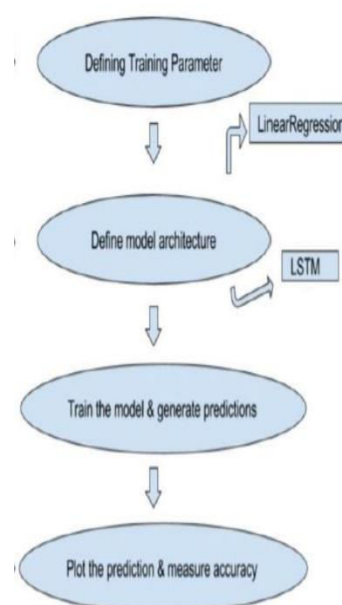


Figure 1: Proposed Architecture

APPROACH

The aim of this project is to accurately predict the future closing value of a given cryptocurrency (here bitcoin)

across a given period of time. For this project Long Short Term Memory networks – usually just called LSTMs are used to predict the closing price of the cryptocurrency using a dataset of past prices.

For this project measure of performance is the Mean Squared Error (MSE) and Root Mean Squared Error (RMSE) calculated as the difference between predicted and actual values of the target currency at adjusted close price.

A. DATA COLLECTION

The historical data of the currency is taken from coinmarketcap.com which provides open, high, low, close, and volume of the currency for a particular date.

The dataset is of following form:

	A	B	C	D	E	F
1	DATE	Open	High	Low	Close	Volume
2	Nov 08, 2021	63344.07	67673.74	63344.07	67566.83	41125608330
3	Nov 07, 2021	61554.92	63326.99	61432.49	63326.99	24726754302
4	Nov 06, 2021	61068.87	61590.68	60163.78	61527.48	29094934221
5	Nov 05, 2021	61460.08	62541.47	60844.61	61125.67	30605102446
6	Nov 04, 2021	62941.8	63123.29	60799.66	61452.23	32615846901
7	Nov 03, 2021	63254.33	63516.94	61184.24	62970.05	36124731509
8	Nov 02, 2021	60963.25	64242.79	60673.06	63226.4	37746665647
9	Nov 01, 2021	61320.45	62419	59695.18	61004.41	36150572843

Figure 2: Dataset

It can be inferred from the dataset that date, high and low values are not important features of the data as it does not matter at what was the highest price of the cryptocurrency for a particular day or what was the lowest trading price. What matters is the opening price of the cryptocurrency and closing price of the cryptocurrency. If at the end of the day there is higher closing price than the opening price that means trading was profitable on that particular day. Also volume of cryptocurrency is important as a rising market should see rising volume and decreasing volume show lack of interest and this is a warning of a potential reversal. A price drop (or rise) on large volume is a stronger signal that something in the cryptocurrency has fundamentally changed. Therefore date, high and low features are removed from data set at preprocessing step.

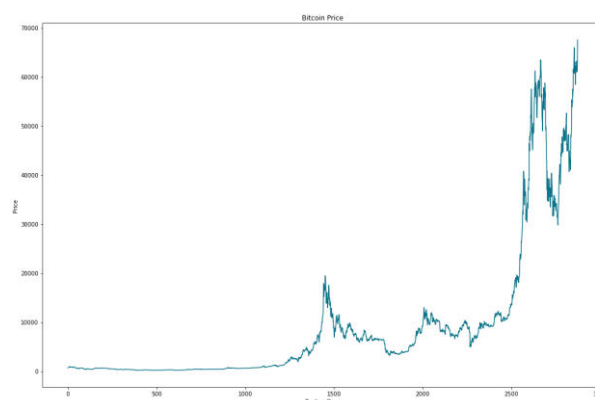


Figure 3: Bitcoin Trend over Time

B. NORMALIZING DATA

After analysing the past trends and identifying the parameters affecting the current price, preprocessing of the data is done using numpy and pandas library. The mean, standard deviation, maximum and minimum of the data was found to be following:

```

Open --- mean : 9012.430187891421    Std: 14124.29069276263    Max: 66002.23    Min: 176.9
High --- mean : 9267.362787056367    Std: 14542.198289108557    Max: 67673.74    Min: 211.73
Low --- mean : 8743.072752261654    Std: 13678.28975059264    Max: 63610.67    Min: 171.51
Close --- mean : 9035.664537230357    Std: 14165.95163432428    Max: 67566.83    Min: 178.1
Volume --- mean : 12804081929.150661    Std: 1955136010.228695    Max: 350968000000.0    Min: 2857830.0

```

Figure 4: Data Metrics

The data is normalized using MinMaxScaler helper function from Scikit-Learn.

The normalized data is found to be following:

```

Item  Open  Close  Volume
0  0.008908  0.008265  0.000125
1  1  0.008524  0.008158  0.000084
2  2  0.008373  0.008413  0.000046
3  3  0.008575  0.008578  0.000051
4  4  0.008863  0.008546  0.000051

Open --- mean : 0.13422690304615917    Std: 0.21457227320793723    Max: 0.9999999999999999    Min: 0.0
Close --- mean : 0.13143984961922164    Std: 0.2102124737225981    Max: 1.0    Min: 0.0
Volume --- mean : 0.03647434619860344    Std: 0.05570734429448969    Max: 1.0    Min: 0.0

```

Figure 5: Normalized Data Values

C. BENCHMARK MODEL

A Linear Regression model is used as primary benchmark. This linear regressor is used for error rate comparison of MSE and RMSE utilizing the same dataset as the LSTM model.

The dataset was splitted into the training (68.53%) and test (31.47%) datasets for linear regression model. The split was of following shape:

```
x_train (1969, 1)
y_train (1969, 1)
x_test (905, 1)
y_test (905, 1)
```

Figure 6: Training and Test Split for Benchmark Model

Following is the predicted results from the benchmark model:

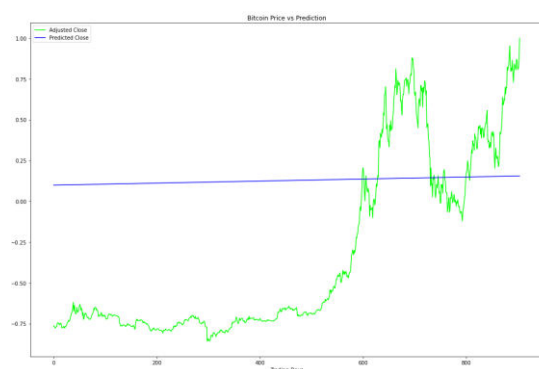


Figure 7: Price Prediction of Benchmark Model

Result of benchmark model:

```
Train Score: 0.4827 MSE (0.6948 RMSE)
Test Score: 0.48903203 MSE (0.69930825 RMSE)
```

Figure 8: Result of Benchmark Model

D. LONG SHORT TERM MEMORY (LSTM) MODEL

Keras library is used for implementation of LSTM model. Keras is an open-source software library that provides a Python interface for artificial neural networks.

The dataset was split into the training (80%) and test (20%) datasets for LSTM model. The Split was of following shape:

```
x_train (2318, 50, 3)
y_train (2318,)
x_test (446, 50, 3)
y_test (446,)
```

Figure 9: Training and Test Split for LSTM Model

A Long-Short Term Memory model is built and then trained with one epoch only. The prediction is made using test data. Following is the predicted results from the LSTM model:

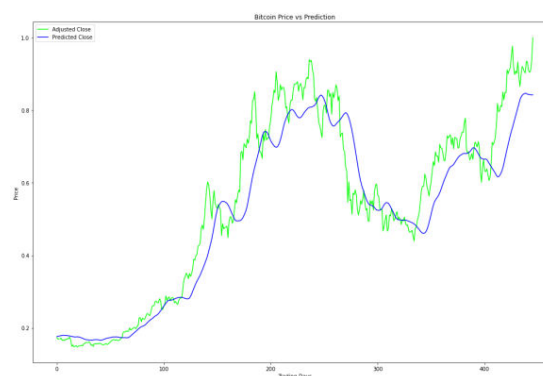


Figure 10: Price Prediction of LSTM Model

Result of LSTM model:

```
Train Score: 0.00018942 MSE (0.01376287 RMSE)
Test Score: 0.00699238 MSE (0.08362046 RMSE)
```

Figure 11: Result of LSTM Model

RESULTS

For benchmark model using linear regression model:

- Train Score: 0.4827 MSE (0.6948 RMSE)
- Test Score: 0.48903203 MSE (0.69930825 RMSE)

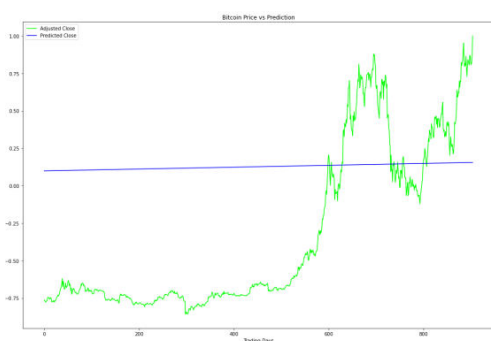


Figure 12: Plot of Linear Regression Model

For Long-Short Term Memory model:

- Train Score: 0.00018942 MSE (0.01376287 RMSE)
- Test Score: 0.00699238 MSE (0.08362046 RMSE)

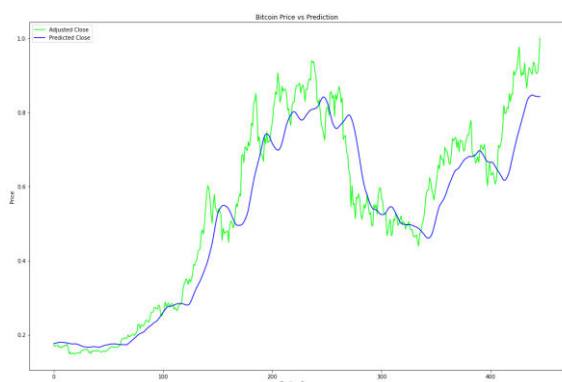


Figure 13: Plot of Long-Short Term Memory model

Comparing the benchmark model - Linear Regression to the LSTM model, the Mean Squared Error improvement ranges from 0.48903203 MSE (0.69930825 RMSE) [Linear Regression Model] to 0.00699238 MSE (0.08362046 RMSE) [LSTM Model]. This significant decrease in error rate clearly shows that LSTM model have surpassed the benchmark linear regression model.

FUTURE SCOPE

This approach predicts closing price of bitcoin cryptocurrency with a small Mean Squared Error. There are many things that can be incorporated some of which include:

- A UI can be provided where user can check the value for future dates.
- The cryptocurrency used here is bitcoin only. More currencies can be added in the future.

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