

A Study on Deep Learning Techniques to Improve Bitcoin Price Prediction

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Abstract—Bitcoin is so far is been the most versatile form of the cryptocurrency we came across in recent times, and the one which is widely accepted as well. Its values are varying like anything as we can see the frequent variation in the market value. We can say that this variation is dependent on various factors which a simple linear form of an equation or the method may fail to predict. In such a condition, it is very important that we apply a more efficient way of prediction. Several methods were employed having mathematical models which didn't give out the expected results. Deep learning methods are widely known to solve such conditions, due to which the Recurrent Neural Networks come into the picture with its ability to learn the problem with the previous literature data. It can analyze the previous value and variations in the bitcoin pricing and using it as its base of knowledge, it can make the predictions more accurate. Even more by restructuring the activation function inside the Recurrent Neural Networks, its prediction accuracy can be further improved.

Keywords—Activation Function, Bitcoin, Deep Learning, Prediction, Recurrent Neural Networks

I. INTRODUCTION

Eventualities may occur at any point in time and there are those that lead to an increase/decrease in the bitcoin pricing. As we know how unpredictable the economy could be, it may be due to many known and unknown factors. This study aims at predicting bitcoin pricing by analyzing the previous literature data. Various events can lead to a change in pricing. For example, events like the economic variation in countries and the supporting factors such as the global market trades will lead to price variation of the bitcoin[1]. This study is expected to analyze the variation and the price values in the past times to analyze to learn and to predict the value which is most likely to occur in the future. By collecting and analyzing data from past records it is certain to be able to observe the various events that occurred in the past and compare it to the present events so that the prediction can be made. No matter how the adverse conditions may occur a machine which self-learned the previous data will be able to interpret a solution with a high level of accuracy and is much less prone to producing errors. As for any mathematical linear model which is developed can only analyze the same problem in a single dimension. On the other hand, these models are capable beyond that of a single dimension. The Artificial Neural network[2] can analyze each and every aspect in the form of layered architecture to gain and experience about the incidents happened in the past

and how the economy can withstand to any eventuality which it may encounter in the coming days. With the RNN in place and its ability to store.

II. LITERATURE SURVEY

In recent times only, the term bitcoin became so popular and all started looking into it, initially the price of it was very low that none took much interest in looking into its values as the tie went by its popularity enraged its hike in its values it is also due to the changes in crypto market exchange values, it was initially predicted using extended Vector Autoregressive model[3], The Lasso methods were used to analyze them and to find the varying parameters[4] some of them were to return, volatility and trading volume of Bitcoin[5], evenmore on the economic policy uncertainty index. The Bayesian Graphical Structural Vector Autoregressive model, Ordinary Least Squares and the Quantile-on-Quantile Regression estimations were also employed [6]and increasing with the varying values became more complicated some neural fuzzy methods came into picture predicting it more accurately[7] before it the idea of prediction done using the frequency of repetition of data and stock market exchange by collecting data for different frequency of data collected and by using high-frequency data models[8]and also by using Multifractal

analysis of Bitcoin market [9][10]. Another way of predicting can be done using the random matrix theory minimum spanning tree model[11]. The ANN was also being used with itself learning capabilities and the predictions came much closer to the actual values[12]. even more, has been achieved with the introduction of RNN it still evolves[13]

Recurrent neural networks (RNNs) is one of the methods to predict models for sequential data. End-to-end training methods such as Connectionist Temporal Classification which makes it possible to train RNNs for sequence labeling problems, at situations where the input-output structure is not known beforehand. By using these methods with the Long Short-term Memory (LSTM)[14] in the RNN architecture it was able to optimize cursive handwriting recognition. Even though it was able to optimize the speech patterns[15] and recognize it the success ratio was not so remarkable which still in development phase using other methods.

The LSTM networks are in huge demand these days. The LSTM network is known by the name cells and these cells take the input from the previous state h_{t-1} and current input x_t . The first and foremost function of this system is to keep what is required and to remove the unnecessary elements from the memory. The current memory data, from the previous literature and the given inputs work together to predict the next output[16].

Along with these deep learning algorithms there are many more algorithms which are currently used in the area of forecasting and making predictions which include the ANN[17] and CNN[18] which are most popular among them, and another one is the predictive deep Boltzmann machine (PDBM) which is also capable of making very good forecasting[19]. Since this method is capable of utilizing and learning from each step of its own development and thus to outrun eventualities which may occur to it at any instance maintaining the Integrity of the Specifications

III. RESEARCH PROPOSAL

There are systems available which are able to predict the bitcoin value pricing near to the original pricing as of now, even though it still lacks the complete precision to pinpoint the value. Using the method of RNN where it can only remember its last transaction details, by modifying the activation function by adding an extra layer of traceback functions along with it multiple times over where in which it will be enabled to retain more of the last occurrences and it will be able to improve its accuracy with this methodology. The added functions in the RNN is expected to create links and references to the more previous parts of its memory to make it aware and to tap into the literature it had from the beginning. The system which remembers more of the past

will certainly have more experience and will be much better and pinpointing the value.

IV. METHODOLOGY

A. Introduction

The data from the standard data sets enable to look deep into the values and changes occurred during the days and the variation and hike and sink in the value of the bitcoin as well, Fig.1 depicts the idea in the pictorial form. These data can be fed into the system and can be made to learn the conditions and the yield we were able to get at each condition, it should also be trained in the current situations and the economic status the world currently running on along with the various factors which lead to the abrupt changes in the society considering from all the viable sources which we can get the data the system can decide on how to use the given input also the main thing is that rather than merely seeing and applying the data it interprets the data which it has been fed into. Once the data is received differently in many ways and multiple links are formed out of it in the system its links and reads and retraces it in a certain pattern, all these data fed up are part of like it then, all the gathered information can be used to make the predictions along the current situations and scenario know to it.

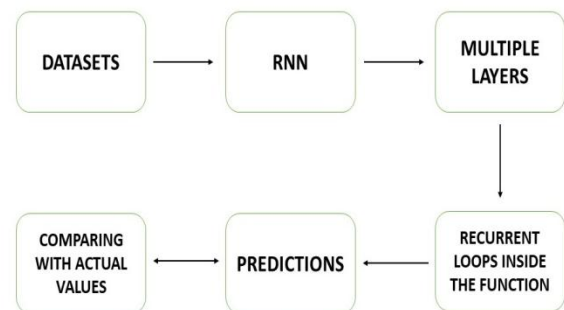


Fig.1.Data Flow Diagram

B. Algorithm used for implementation

Recurrent Neural Networks (RNN) have become the backbone of the current neural network architecture those which involve multi-aspect prediction mechanisms. Over the last few years, the recurrent architecture for neural networks has drastically improved with the advancement in technology and the amount of computing power it can pool into — from Named Entity Recognition to Language Modelling through Machine Translation.[20].The model for is depicted as in Fig.2.

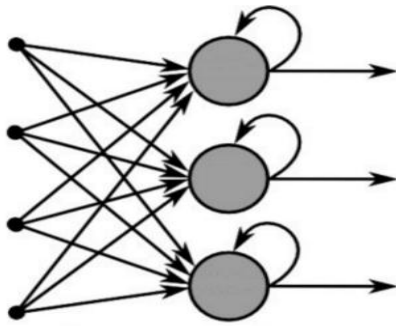


Fig.2. Recurrent Neural Networks[21]

The RNN's deal with sequential data, by taking advantage of the initial information it can gather on and the memory where it can be stored. The success of RNN in NLP tasks is mainly because of its ability to deal [22]with large amounts of sequential data and the data analysis it can perform to give adequate results with reference to time. While the Ann considers current input which it is been given, RNN utilizes both the current input and the context which its built upon, and the initial data is used to learn and develop itself in such a way that it is capable of interpreting the data by itself [21].

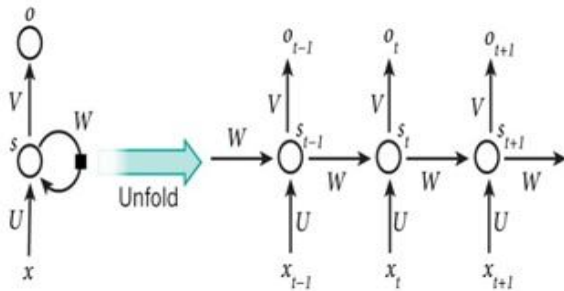


Fig.3.Mathematical Model For RNN[21]

C. Input/output data

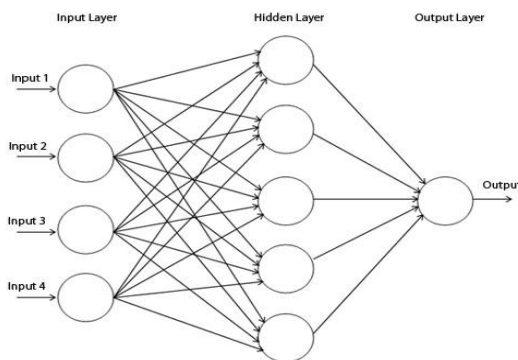


Fig.4. Input-Output Flow In RNN[13]

The Input data includes the databases on bitcoin price data charts which are freely available in Kaggle which should enlighten the system with the rise and fall in the bitcoin price status may suffer due to different conditions it may tackle upon. Between the input and output data pairs, there is a module which should perform fall and rise in the economy based on the presented inputs. Each of the input is given as the percentage number. Also, the values are presented in percentage. The Fig.4 shows how the data is mapped from input to output for making decisions

The input will be the pricing at different dates and which can tell the rise and fall and the discrepancies in the value variations

D. Designing of RNN system

Identification of this system depended on this layered architecture is solely because of the virtually infinite number of layers we can add and train to meet our goals, there are exhaustive number of ways this system can be trained, and the data fed upon the system at its initial state plays a vital role in the entire outcome.[13].The system can be fully developed with the deep neural network library functions which are available in the python platform itself.

There are different concepts for designing and development of information system. In this article, the enhanced RNN System which presents the main architecture of the system, which makes it aware of the current scenario and to make it experienced in such a way that the entire data it has will be its asset in a way to predict the outcomes. The so collected data which it had is already a knowledge which we are providing initially from the data sets, even more, the data obtained while learning will also be interpreted again to make the predictions more accurate.

V. CONCLUSION

The main purpose of this study is to improve the existing method of predicting the bitcoin price by applying and adding recurrent loops in the activation function inside the RNN model. Using the python modules and deep learning libraries which is expected to improve the previous remembrance of the system, by making it more precise in the predictions of the value, to make it getting close in predicting the value to the actual bitcoin price

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REFERENCES

- [1] S. Karasu, A. Altan, Z. Sarac, and R. Hacioglu, "Prediction of Bitcoin prices with machine learning methods using time series data," in 2018 26th Signal Processing and Communications Applications Conference (SIU), 2018, pp. 1–4.
- [2] A. K. Jain, Jianchang Mao, and K. M. Mohiuddin, "Artificial neural networks: a tutorial," *Computer (Long Beach, Calif.)*, vol. 29, no. 3, pp. 31–44, Mar. 1996.
- [3] P. Giudici and I. Abu-Hashish, "What determines bitcoin exchange prices? A network VAR approach," *Financ. Res. Lett.*, no. February, pp. 0–1, 2018.
- [4] T. Panagiotidis, T. Stengos, and O. Vravosinos, "On the determinants of bitcoin returns: A LASSO approach," *Financ. Res. Lett.*, vol. 27, no. February, pp. 235–240, 2018.
- [5] H. A. Aalborg, P. Molnár, and J. E. de Vries, "What can explain the price, volatility and trading volume of Bitcoin?," *Financ. Res. Lett.*, no. July, pp. 1–11, 2018.
- [6] E. Demir, G. Gozgor, C. K. M. Lau, and S. A. Vigne, "Does economic policy uncertainty predict the Bitcoin returns? An empirical investigation," *Financ. Res. Lett.*, vol. 26, no. January, pp. 145–149, 2018.
- [7] G. S. Atsalakis, I. G. Atsalaki, F. Pasiouras, and C. Zopounidis, "Bitcoin price forecasting with neuro-fuzzy techniques," *Eur. J. Oper. Res.*, 2019.
- [8] F. N. Zargar and D. Kumar, "Informational inefficiency of Bitcoin: A study based on high-frequency data," *Res. Int. Bus. Financ.*, vol. 47, no. April 2018, pp. 344–353, 2018.
- [9] A. C. da Silva Filho, N. D. Maganini, and E. F. de Almeida, "Multifractal analysis of Bitcoin market," *Phys. A Stat. Mech. its Appl.*, vol. 512, pp. 954–967, 2018.
- [10] M. El Alaoui, E. Bouri, and D. Roubaud, "Bitcoin price–volume: A multifractal cross-correlation approach," *Financ. Res. Lett.*, no. September, pp. 1–8, 2018.
- [11] D. Stosic, D. Stosic, T. B. Ludermir, and T. Stosic, "Collective behavior of cryptocurrency price changes," *Phys. A Stat. Mech. its Appl.*, vol. 507, pp. 499–509, 2018.
- [12] M. Nakano, A. Takahashi, and S. Takahashi, "Bitcoin technical trading with artificial neural network," *Phys. A Stat. Mech. its Appl.*, vol. 510, pp. 587–609, 2018.
- [13] K. Cho et al., "Learning Phrase Representations using RNN Encoder-Decoder for Statistical Machine Translation," Jun. 2014.
- [14] S. Bouktif et al., "Optimal Deep Learning LSTM Model for Electric Load Forecasting using Feature Selection and Genetic Algorithm: Comparison with Machine Learning Approaches †," *Energies*, vol. 11, no. 7, p. 1636, Jun. 2018.
- [15] A. Graves, A. Mohamed, and G. Hinton, "Speech recognition with deep recurrent neural networks," in 2013 IEEE International Conference on Acoustics, Speech and Signal Processing, 2013, pp. 6645–6649.
- [16] S. Hochreiter and J. Jürgen Schmidhuber, "Lstm," *Neural Comput.*, vol. 9, no. 8, pp. 1735–1780, 1997.
- [17] Xin Yao, "Evolving artificial neural networks," *Proc. IEEE*, vol. 87, no. 9, pp. 1423–1447, 1999.
- [18] L. O. Chua and T. Roska, "The CNN paradigm," *IEEE Trans. Circuits Syst. I Fundam. Theory Appl.*, vol. 40, no. 3, pp. 147–156, Mar. 1993.
- [19] C.-Y. Zhang, C. L. P. Chen, M. Gan, and L. Chen, "Predictive Deep Boltzmann Machine for Multiperiod Wind Speed Forecasting," *IEEE Trans. Sustain. Energy*, vol. 6, no. 4, pp. 1416–1425, Oct. 2015.
- [20] G. Diakun, L. Fairall, and A. Klug, "© 1986 Nature Publishing Group," *Nature*, vol. 324, pp. 698–699, 1986.
- [21] "Top Research Papers On Recurrent Neural Networks For NLP Enthusiasts." [Online]. Available: <https://www.analyticsindiamag.com/top-research-papers-on-recurrent-neural-networks-for-nlp-enthusiasts/>. [Accessed: 21-Jan-2019].
- [22] Sin-Horng Chen, Shaw-Hwa Hwang, and Yih-Ru Wang, "An RNN-based prosodic information synthesizer for Mandarin text-to-speech," *IEEE Trans. Speech Audio Process.*, vol. 6, no. 3, pp. 226–239, May 1998.