Abstract

Predicting Bitcoin Prices with Recurrent Neural Networks

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With Machine Learning (ML) and Finance intersecting in recent years, this study aims to bridge the gap between the subjects using ML models as the vehicle for accurately predicting Time Series data on Cryptocurrencies. The project evaluates Time Series Models such as Long Short-Term Memory (LSTM), Gated Recurrent Unit (GRU), and compare against others, to investigate how they perform on historical price data without being discriminated to a bias. Our Bitcoin dataset covers the last 4 years as a basis due to market conditions in recent years caused by COVID-19, recessions and the 2024 halving event. This makes it a perfect time to analyse and evaluate models by splitting the dataset into training, validation, and test sets. In doing so, we can investigate not only how the models learn and adapt to hyperparameters, but also evaluate each model’s ability to generalise unseen data. Our study will measure the performance by activation functions and mathematical proofs to further optimise predictions.

This study uses supervised learning with performance bias checks, such as Mean Squared Error, to measure its applicability towards real world predictions with data coming from public Interfaces such as Yahoo Finance which is stored locally with its original integrity for convenience.

**Keywords:** RNN, GRU, ANN, model, accuracy.

1 Introduction

While cryptocurrency offers lucrative returns, its inherently volatile as the fluctuation of people’s interest in the decentralized space shifts causing observations to be a challenge to get accurate algorithmically, especially within certain intervals. However, using machine learning we can adopt some learning models to predict potential future forecasts of timeseries data price action to determine when investing is the most appropriate. Modern civilisation without such technologies would struggle to make fast decisions on price prediction in small time frames which is why we want to investigate how leveraging the use of the internet with machine learning models can improve accumulative returns on the market whilst addressing the efficiency and accuracy metrics of our models. Integrating computational learning into our research would demonstrate the intelligence of machines to perform decision making upon the use of training data and with the use of LSTMs we can expand our domain knowledge about market predictions in the future to fine-tune accuracy if needed.

* We show how LSTMs can be used to perform market predictions with high accuracy.
* We propose GRUs and LSTMs effectiveness within different lengths of time frame sequentially.
* We demonstrate how the models bridge the gap of general purpose Artificial Neural Networks in relation to time series data.

2 Related Work

**2.1 Long Short-Term Memory Models**

**2.2 Gated Recurrent Networks**

4 Experiments

**4.1 Methods**

**Datasets and Pre-processing**

Some text

**Training Procedure**

Some text

**4.2 Results and Discussion**

Accuracy, time complexity, variables, performance.

**Table 1.** Test accuracy

5 Conclusion

**6 References**

**7 Appendix**