

# **Time Series Prediction with Neural Networks**

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# **Abstract**

Neural networks are state of the art mathematical models. In this investigation, several models were evaluated based on their performance predicting the price of cryptocurrency. Ultimately, a transformer network was developed to predict changes in price with time. Evaluation criteria were prediction accuracy and performance in a simulated trading environment.

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# Introduction

Cryptocurrencies are volatile assets whose prices are known to fluctuate wildly with no discernable pattern. Traders use mathematical models to regularize price data to make assessments and predictions. Could a neural network with training, develop its own mathematical understanding of price movements and be able to make accurate predictions and maximize profits from trading. Several network models are herein considered and evaluated for their performance, both in prediction accuracy, and trading results in a simulated market. Beyond different network architectures, two distinct methods for generating data from raw price data are considered. Traditional price interpretations - like exponential moving averages, moving average convergence divergence, or stochastic relative strength index – are purposely avoided while generating network data; the network model is expected to develop its own understanding of price changes.

In practice, a trader can only buy or sell an asset. To profit from both increases, and decreases in price, a trader can long and short assets. A long is the act of purchasing an asset at a price with the expectation of selling it at a higher price. A short is the act of selling an asset, with the expectation of purchasing an equal amount to that sold at a lower price. If a trader could make trades with one hundred percent accuracy, they would at any given moment, either be in a long or a short. The first data model aims to have perfect accuracy in this sense, and the aim of this model is to transform price data to the corresponding long or short signal.

The other data model considered converts changes in price with respect to time, to a sequence of integers. Frequency bins corresponding to the histogram of the assets changes in price are used to determine the integer at a given time. This model's explicit task is to predict the next time step of the price change sequence.

# Trade Optimization