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# Crytocurrency Portfolio Management with Convolution Neural Networks

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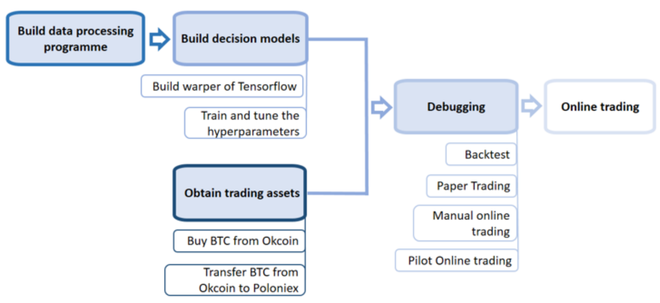
## Abstract

In this project, we are trying to make money by buying and selling different cryptocurrencies. We are using Convolutional Neural Network (CNN) in our programme to perform these trading tasks automatically. The logics that determine what to buy/sell are some CNNs composed of three layers: one CNN layer, one Fully-Connected layer and a Softmax layer without pooling and peddling. We only consider assets with top 12 volumes to ensure fluidity and avoid lost by taking market orders. The total return of paper trading is 2.4% for 5 days which is a good performance. However, the total return of online trading is -12.5%.

## Work Flow

- Work Flow



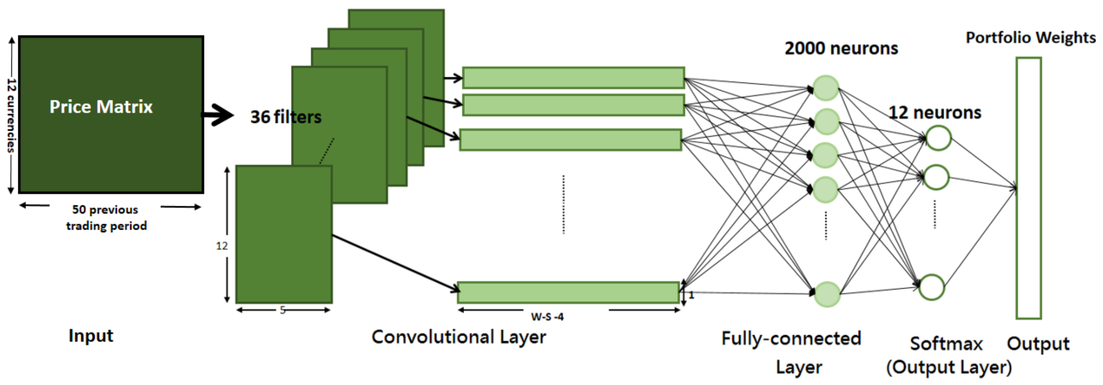

- Technology Employed

Tensorflow, Python, Pandas, Numpy, Amazon Web Service, Git

## Model Establishment

- Convolutional Neural Network (CNN)

Convolutional neural networks (CNNs) consist of multiple layers of small neuron collections which process portions of the input, called receptive fields.



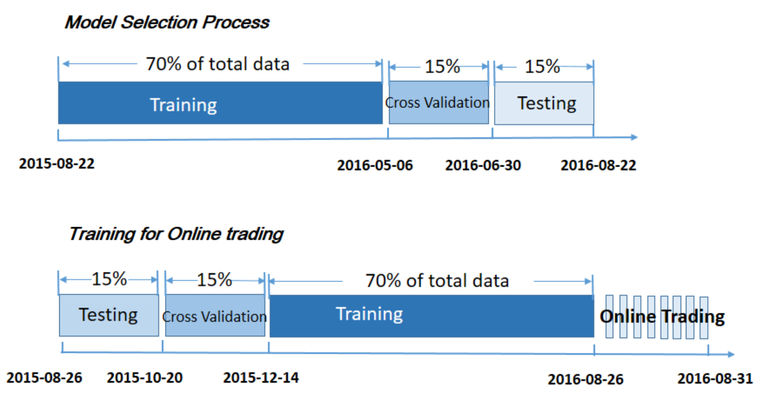

The logics that determine what to buy/sell are some CNNs composed of three layers: one CNN layer, one Fully-Connected layer and a Softmax layer without pooling and peddling. NNs are used in our online trading which was lasted for 5 days and trading started 30 mins per period.

- Loss Function

$$f = \sum \ln(\omega \cdot y)$$

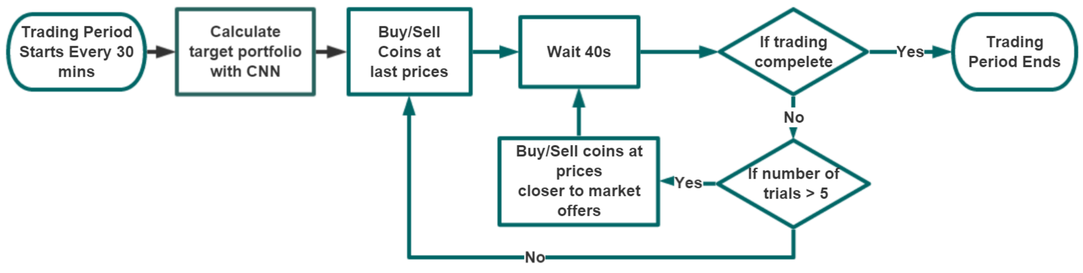
We directly generate a portfolio portion(omega), each element of which represents the proportion of the total capital that would be put into the asset. The loss function is based on the total capital in the next period.

- Model Selection and Training Process




## Trading Algorithm

- Trading Algorithm




Trading period started every 30 mins. We try ten times each time every 40 seconds. The online trading process was lasted for 5 days.

## Trading Experiment

- Top 12 volumes coins we selected

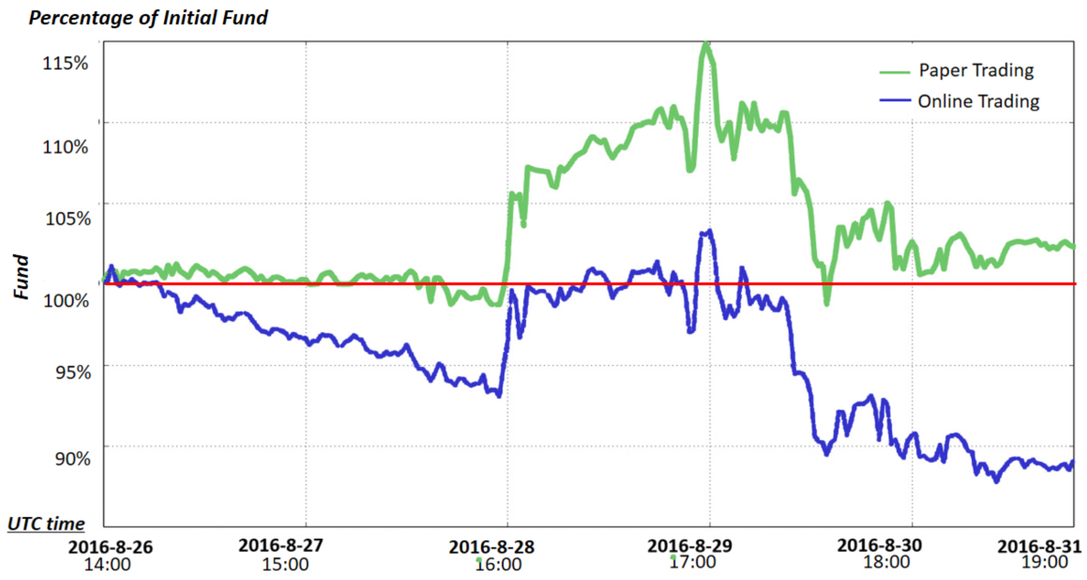
| | | | | | |
|---|---|---|---|---|---|
| BTC | ETC | DASH | USDT | ETH | LSK |
| BTS | FCT | MAID | STEEM | XMR | LTC |

The top 12 volumed coins we used to ensure fluidity and avoid lost by taking market orders.

- Trading Experiment

Auto-trading starts from 2016/8/26 14.00 (UTC time), end at 2016/8/31 19.00 (UTC time). Please notice that the total asset change of the paper trading has been divided by 2, in order to fit the situation of the online trading. Because in the online trading, there are 50% of BTC were reserved for quickly buying. Trading period starts every 30 mins.

- Comparison of Paper Trading and Online Trading




- Trading Performance

| Performance | Online Trading | Paper Trading |
|---|---|---|
| Total Return | -12.5% | 2.4% |
| Standard Deviation | 0.83% | 0.88% |
| Mean return | -0.048% | 0.013% |
| Max Drawback | 15.0% | 14.1% |

The reference asset is the initial fund. The differences between the online trading and paper trading still exists. The reason could be the trade could not succeed at the last price or coincidence.

- Paper and Online Trading Discrepancy Causes Example

| Time | Type | Coin | Initial Attampted Price（BTC） | Closing Price（BTC） | Number Of Trails |
|---|---|---|---|---|---|
| 2016-08-27 22:00 | Buy | MAID | 0.00019477 | 0.00019525 | 8 |
| 2016-8-29 06:30 | Sell | MAID | 0.00018303 | 0.00018125 | 9 |
| 2016-08-29 15:30 | Sell | FCT | 0.00595507 | 0.00598512 | 4 |

- Reflection On Result of Backtest

Normally, others' work were based on the backtest. In our backtest, the algorithm performed quite well but the online trading and paper trading was not so good. That means the backtest may not be the ample evidence to show the performance of a portfolio algorithm.

## Limmitation and Further Improvement

Trading consumption is the big problem in our project , we need further optimize the trading algorithm to reduce fluidity and avoid lost by taking market orders. Considering the market of cryptocurrencies is highly connected with time, we can using other kind of algorithm training the model - Long Short Term Memory(LSTM). Moreover, we can also try American stock market in the future to see if there are any differences.

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