

Project Proposal

Team members: Youzhi Luo, Limei Wang

1. Introduction

Since the appearance of first financial market was set up, people have been trying to predict future trend of price movements for making as many profits as possible. One of the most widely happened financial activity in people's daily life is stocks trading. What people is looking forward to achieving is to buy stocks at low prices and to sell them at high prices. In fact, the process of stocks trading can be formalized as a decision problem easily --- at each trading moment, people are access to some observation (e.g. historical prices), and make some decisions (e.g. buy, sell or wait) to maximize their expected future rewards (profits). Thus it is possible to apply reinforcement learning to stocks trading problem.

2. Project Plan

Generally speaking, our objective of this project is to develop a stocks trading program with popular deep reinforcement learning algorithms (e.g. DQN or PPO). We will try several different deep neural network structures (e.g. Multi-layer perceptron, 1D convolution neural network) as the function approximator, and use value-based or policy-based reinforcement learning architecture to train our neural network. It is expected that our trained stocks trading program is able to make intelligent trading decision given the historical price information of stocks so as to maximize the future profits. Some detailed description about our project is below.

State Space

The state is represented as a four-item vector. Each state vector contains the price information of a stock in the trading interval of one minute, that is, the trading price at the beginning of the interval, the highest price during the interval, the lowest price during the interval and the price at the end of the interval.

Action Space

Just like real stocks trading, there are only three action at decision moment --- sell, buy and do nothing.

Reward

The reward is the amount of profit that will get when doing one of the actions in the action space.

Data

We have collected the Russian stock market price records from 2015 to 2016 as our data in all experiments, which are saved as '.csv' files. Each record contains a four-number tuple, whose meaning is the same as the description of state space. We will choose part of these data for training and evaluate the trained stocks trading system on the remaining data.

Implementation

We plan to use python to implement our stocks trading system, and Pytorch package to implement the deep neural networks. In addition, we will implement a gym-like environment to simulate the stocks trading environment based on our collected stocks price data.