Stock Trading Problem

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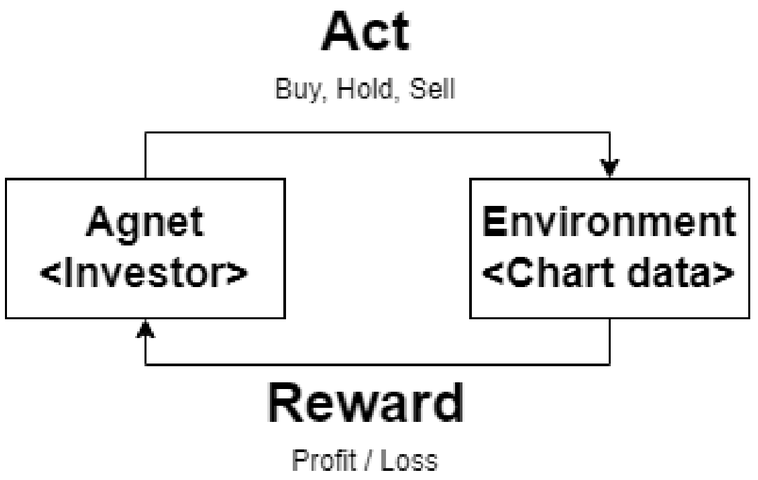

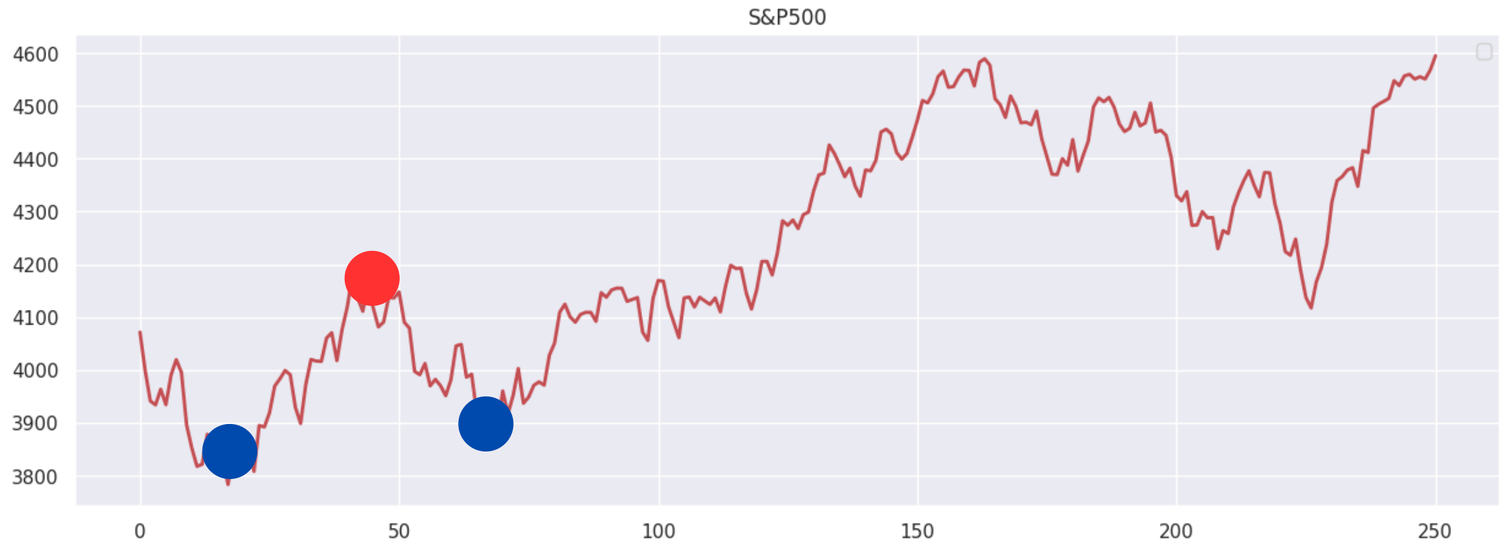

t (day)	S_t (total balance)	A_t (Buy, hold, Sell)	S_(t+1) (total balance)	R_t (investment)
0	10000	hold	10000	0
1	10000	hold	10000	0
2	10000	buy	6058.74	0
3	6058.74	sell	9992.66	-0.19%

Training Data

Data: S&P 500 ‘Close(종가)’

Date: 2022-12-02 ~ 2023-12-01

Reward

((total balance - starting_money) / starting_money) * 100

Modeling Results

(Value-based)**Deep Q-learning**

epoch: 300, total rewards: 232.130, cost: 0.006419, total money: 10232.13
epoch: 350, total rewards: 288.320, cost: 0.003840, total money: 10288.32
epoch: 400, total rewards: 390.790, cost: 0.006037, total money: 10390.79

(Policy-based) **Policy-gradient**

epoch: 380, total rewards: 965.23, cost: -3727.455078, total money: 10965.23
epoch: 390, total rewards: 249.94, cost: -3094.749756, total money: 6083.12
epoch: 400, total rewards: 772.73, cost: -3172.590332, total money: 10772.73

(Value + Policy Based) **Actor-Critic**

epoch: 80, total rewards: -220.470, cost: 2.211571, total money: 9779.53
epoch: 90, total rewards: 735.650, cost: 0.211436, total money: 10735.65
epoch: 100, total rewards: 528.370, cost: 0.274472, total money: 5973.48

Tuning Hyper Parameters

total gains 304.370000, total investment 3.043700%
total gains 401.720000, total investment 4.017200%
total gains 305.070000, total investment 3.050700%

total gains 1820.490000, total investment 18.204900%
total gains 65.840000, total investment 0.658400%
total gains 267.430000, total investment 2.674300%

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total gains -4199.660000, total investment -41.996600%
total gains -3440.140000, total investment -34.0401400%

conclusion

알고리즘	알고리즘	장점	단점
Q-learning	가치 기반 알고리즘	수렴성, 빠른 수렴 속도	큰 상태-행동 공간에서 어려움을 겪을 수 있음
Policy gradient	정책 기반 알고리즘	대규모 행동 공간에서 잘 작동, 확률적인 정책 학습 가능	수렴이 불안정하거나 수렴 속도가 느릴 수 있음
Actor-critic	가치 기반과 정책 기반의 장점을 결합한 알고리즘	수렴이 안정적, 효율적인 학습 가능, 가치와 정책을 동시에 학습	구조가 복잡, 하이퍼파라미터 조정이 어려움

→ 안정적인 투자

→ 고수익 대비 위험 투자

Further Resurch

1.Time series prediction model

실제 주식 시장에 적용을 위해 예측 모델 활용

2.Stock System이해와 도입

모멘텀과 시그런의 관계, 블리저드 밴드

3.Indicators + Historical Price

Indicators(Sentiment, VIX data, News Trend) 함께 고려