Portfolio Analysis with Deep Learning

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Portfolio Analysis?

- Portfolio managers do research and choose some fixed assets
- Managers still need to figure how to weight assets appropriately

Problem

Given assets $A_1, A_2, ..., A_n$ choose weights such that

$$w_1, w_2, ..., w_n \in [0, 1]$$
$$\text{subject to } \sum_{i=1}^{n} w_i = 1$$

Measuring Performance

- Once we have weights how to measure performance?
- Need something we can optimize over

Measuring Performance

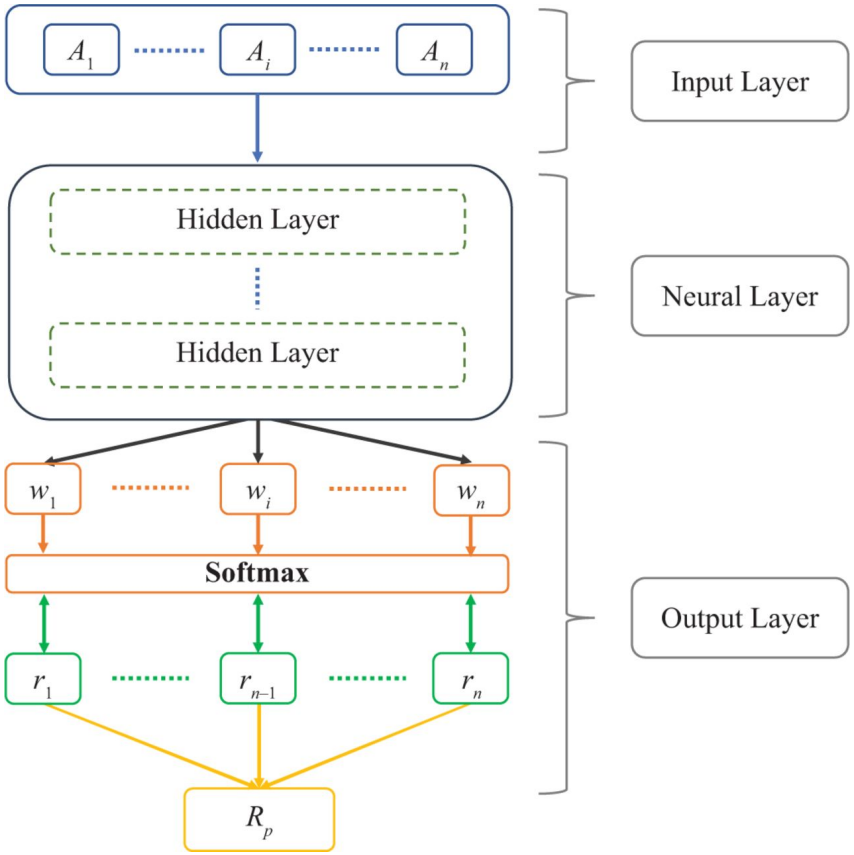
The Sharpe Ratio

$$S = \frac{E[R_p] - E[R_f]}{\sigma_p}$$

- $E[R_p]$ Expected return of portfolio
- $E[R_f]$ Expected return of risk free rate (usually fixed)
- σ_p Standard deviation of portfolio
- Tells us excess returns per unit of risk

Current Ideas

Use architecture based on Deep Learning for Portfolio Optimization



- Features from each asset taken over 30 day window and then concatenated
- LSTM for neural layer
- Softmax to scale weights
- Sharpe Ratio as "loss" function

Future Improvements

- Use transformer instead of LSTM
- Learn input features instead of hand picking them
- Add constraints so that allocation amounts are within a range