Build Night 4

Follow-the-Winner Strategies II

Team Meeting Agenda

- Discuss homework + potential future direction (15min)
- Go over remaining Follow-the-Winner strategies (25min)
- Discuss constrained optimization libraries (5min)
- GitHub basics and norms (10min)
- Data parsing/wrangling + strategy implementation practice (20 min)

Project Schedule

1. Welcome & Problem Definition
2. Power Outage – Python and Reading Review
3. Baseline + Follow-the-Winner Strategies I
4. Follow-the-Winner Strategies II (you are here!)
5. Follow-the-Loser Strategies I
6. Follow-the-Loser Strategies II
7. Pattern-Matching Strategies I
8. Pattern-Matching Strategies II
9. Backtesting, Experimentation, and Comparison
10. Poster Work & Presentation Practice

Project Schedule: Potential Compression?

1. Welcome & Problem Definition
2. Power Outage – Python and Reading Review
3. Baseline + Follow-the-Winner Strategies I
4. Follow-the-Winner Strategies II (you are here!)
5. Follow-the-Loser Strategies
6. Pattern-Matching Strategies
7. Framework I
8. Framework II
9. Backtesting, Experimentation, and Comparison
10. Poster Work & Presentation Practice

Homework Discussion

Follow-the-Winner: Part 2

Follow-the-Leader

- Tracks the BCRP strategy until some time t and uses it as the basis for an optimization problem

$$\mathbf{b}_{t+1} = \mathbf{b}_t^* = \underset{\mathbf{b}\in\Delta_m}{\arg\max} \sum_{j=1}^{t} \log\left(\mathbf{b}\cdot\mathbf{x}_j\right).$$

- This uses historical data up till the current time period and uses that as the basis for future predictions

Follow-the-Leader

- The way this is used for future predictions varies. An approach that combines uniform portfolios with this:

$$\mathbf{b}_{t+1} = \frac{t}{t+1}\mathbf{b}_t^* + \frac{1}{t+1}\frac{1}{m}\mathbf{1}.$$

- This strategy utilizes a *trade-off parameter* to balance the adjustment between the previous trading period and the current one:

$$\mathbf{b}_{t+1} = (1-\gamma)\,\mathbf{b}_t^* + \gamma\,\mathbf{b}_t,$$

Follow-the-Leader

- This strategy compares to a fixed window W in the past:

$$\mathbf{b}_{t+1} = \operatorname*{arg\,max}_{\mathbf{b} \in \Delta_m} \sum_{j=t-W+1}^{t} \log(\mathbf{b} \cdot \mathbf{x}_j),$$

Follow the Regularized Leader

- Works similar to Follow the Leader but adds a regularization function R(b)

$$\mathbf{b}_{t+1} = \arg\max_{\mathbf{b}\in\Delta_m} \sum_{\tau=1}^{t} \log(\mathbf{b}\cdot\mathbf{x}_\tau) - \frac{\beta}{2}R(\mathbf{b}),$$

Follow the Regularized Leader

- There may or may not be a closed form solution? Math is fun :))

$$\mathbf{b}_1 = \left(\frac{1}{m}, \ldots, \frac{1}{m}\right), \quad \mathbf{b}_{t+1} = \Pi_{\Delta_m}^{\mathbf{A}_t}\left(\delta \mathbf{A}_t^{-1} \mathbf{p}_t\right),$$

with

$$\mathbf{A}_t = \sum_{\tau=1}^{t} \left(\frac{\mathbf{x}_\tau \mathbf{x}_\tau^\top}{\left(\mathbf{b}_\tau \cdot \mathbf{x}_\tau\right)^2}\right) + \mathbf{I}_m, \quad \mathbf{p}_t = \left(1 + \frac{1}{\beta}\right) \sum_{\tau=1}^{t} \frac{\mathbf{x}_\tau}{\mathbf{b}_\tau \cdot \mathbf{x}_\tau},$$

where β is the trade-off parameter, δ is a scale term, and $\Pi_{\Delta_m}^{\mathbf{A}_t}(\cdot)$ is an exact projection to the simplex domain.

Universal Portfolios

- Assign capital to a class of experts and pool their wealth, similar to a BAH strategy
- Based on my Internet research, this was a pretty influential strategy when it was published, but is based on an idealized market model
- More study is needed because I still don't know how to implement this! :)

$$\mathbf{b}_{t+1} = \frac{\int_{\Delta_m} \mathbf{b} S_t(\mathbf{b}) d\mu(\mathbf{b})}{\int_{\Delta_m} S_t(\mathbf{b}) d\mu(\mathbf{b})}.$$

$$S_n(UP) = \int_{\Delta_m} S_n(\mathbf{b}) d\mu(\mathbf{b}).$$

Online Portfolio Selection

Universal Portfolios

- For this type of strategy, I think reference implementations will help us understand what's going on better

$$\mathbf{b}_{t+1} = \frac{\int_{\Delta_m} \mathbf{b} S_t(\mathbf{b}) d\mu(\mathbf{b})}{\int_{\Delta_m} S_t(\mathbf{b}) d\mu(\mathbf{b})}.$$

$$S_n(UP) = \int_{\Delta_m} S_n(\mathbf{b}) d\mu(\mathbf{b}).$$

Aggregating-Type Algorithms

- Find a set of base expert stocks that help track the others in a changing market and allocate among the experts
- “I like your funny words, magic man”

$$\mathbf{b}_{t+1} = \frac{\int_{\Delta_m} \mathbf{b} \prod_{i=1}^{t-1} (\mathbf{b} \cdot \mathbf{x}_t)^{\eta} P_0(d\,\mathbf{b})}{\int_{\Delta_m} \prod_{i=1}^{t-1} (\mathbf{b} \cdot \mathbf{x}_t)^{\eta} P_0(d\,\mathbf{b})},$$

Online Portfolio Selection

Constrained Optimization

Github Basics and Norms

The Basics

- Commits
- Branches
- PRs
- Issues

Data Wrangling & Strategy Implementation Practice

Homework

This Week

- On Github (will be modified soon)
- 2 weeks from now is Spring Break, so we'll have the meeting after (look for the invite soon!)