ML@B

SAP Algorithm Outline

Notation:

- D: Data matrix

  - D_i: Datapoint with format $\{\text{close price} - \text{open price}, \text{low}, \text{high}, \text{volume}, F_{i-1}\}$

- F: Trade value

  - $F_i = D \cdot \Theta = D_{i0}\Theta_0 + D_{i1}\Theta_1 + D_{i2}\Theta_2 + D_{i3}\Theta_3 + D_{i4}\Theta_4$

  - The 0th - 3rd components are calculated at initialization, the fourth component is calculated later

  - $F'_i = D_{i0}\Theta_0 + D_{i1}\Theta_1 + D_{i2}\Theta_2 + D_{i3}\Theta_3$

  - $F_i = F'_i + \Theta_4 F_{i-1} = \sum_{j=0}^{i} \Theta_4^{i-j} F'_i$

- R_i: The reward function at time step i

  - $R_i = F_i D_0 - \partial(F_i - F_{i-1})$

- Gradient Equations

  -
  $$\frac{\partial R_t}{\partial F_t} = \begin{cases} -1 \text{ if } F_{t-1} < F_t \\ +1 \text{ else} \end{cases}$$

  -
  $$\frac{\partial R_t}{\partial F_{t-1}} = D_{t0} - \begin{cases} -1 \text{ if } F_{t-1} < F_t \\ +1 \text{ else} \end{cases} = D_{t0} - \frac{\partial R_t}{\partial F_t}$$

  -
  $$\frac{\partial F_t}{\partial \Theta} = D_t$$

  -
  $$\frac{\partial U_t}{\partial \Theta} = \sum_{i=1}^{t} \frac{\partial U_t}{\partial R_t} \left(\frac{\partial R_t}{\partial F_t} \frac{\partial F_t}{\partial \Theta} + \frac{\partial R_t}{\partial F_{t-1}} \frac{\partial F_{t-1}}{\partial \Theta} \right)$$

- U: