Danilo de Freitas Naiff

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Abstract

Objetive:

$$
\begin{aligned}
&\text{maximize} \\
&\quad x_T^T \alpha \\
&\text{s.t.} \\
&\quad \alpha \in \Delta_N \\
&\quad (1-\gamma) \max_{s \in 0,\dots,t} x_s^T \alpha - x_t^T \alpha \leq 0, \forall t.
\end{aligned} \tag{1}
$$

Here, γ is the drawdown tolerance, x_t the portfolio price vector at t, and α is the asset.

If we define m_t as an "envelope" for the series maximum, then minimizing the following problem is equivalent to minimize the original problem:

$$
\begin{aligned}
&\text{minimize} \\
&\quad (-\lambda_1 x_T, \lambda_2 \mathbf{1}_N)^T (\alpha, m) \\
&\text{s.t.} \\
&\quad -\alpha \leq 0 \\
&\quad (1-\gamma) m_t - x_t^T \alpha \leq 0, \quad t = 1, \dots, N \\
&\quad m_t - m_{t+1} \leq 0, \quad t = 1, \dots, N-1 \\
&\quad x_t^T \alpha - m_t \leq 0, \quad t = 2, \dots, T \\
&\quad \mathbf{1}^T \alpha - 1 = 0 \\
&\quad m_1 - x_1^T \alpha = 0
\end{aligned} \tag{2}
$$