
Algorithm 1 End-to-End Quantitative Strategy Backtest

Input: Start/End Date T_{start}, T_{end} , Stock Pool Definition P , Factor Data F , Return Data D_{ret} , Industry Tolerance ϵ , Fee Rate γ

Output: Daily Net Returns R_{net} , Performance Metrics M

// Phase 1: Data Preparation & Alpha Generation

- 1: $D_{status} \leftarrow \text{LoadAndFilterStatus}(P)$
- 2: $S_{all} \leftarrow \emptyset$
- 3: **for** year $y \in \text{Years}(T_{start}, T_{end})$ **do**
- 4: **if** Cache exists for y **then**
- 5: $S_y \leftarrow \text{LoadCache}(y)$
- 6: **else**
- 7: $D_{merged} \leftarrow \text{Merge}(D_{status}[y], F[y])$
- 8: $S_y \leftarrow \text{CalculateFactorScore}(D_{merged})$ ▷ Apply alpha formula
- 9: $\text{SaveCache}(S_y)$
- 10: **end if**
- 11: $S_{all} \leftarrow S_{all} \cup S_y$
- 12: **end for**
- 13: $D_{full} \leftarrow \text{Merge}(S_{all}, D_{ret})$

// Phase 2: Portfolio Construction & Execution (Daily Loop)

- 14: Initialize Weights $W_{t=0} \leftarrow \mathbf{0}$
- 15: **for** day $t \in [T_{start}, T_{end}]$ **do**
- 16: *Step 2.1: Screening & Initial Weighting*
- 17: $Univ_t \leftarrow \{i \in D_{full}[t] \mid \text{Tradable}_i \wedge \text{NotST}_i \wedge \text{NotIPO}_i\}$
- 18: $Sel_t \leftarrow \{i \in Univ_t \mid \text{Score}_{i,t} \geq 1\}$
- 19: $w_{i,t} \leftarrow 1/|Sel_t|$ for $i \in Sel_t$, else 0 ▷ Equal weight
- 20: *Step 2.2: Industry Neutralization (Iterative)*
- 21: **repeat**
- 22: $R_{curr} \leftarrow \text{CalcIndustryWeights}(W_t)$
- 23: $R_{tgt} \leftarrow \text{CalcMarketIndustryWeights}(D_{full}[t])$
- 24: **for** industry k **do**
- 25: **if** $|R_{curr}[k] - R_{tgt}[k]| > \epsilon$ **then**
- 26: $\alpha \leftarrow (R_{tgt}[k] \pm \epsilon) / R_{curr}[k]$
- 27: $w_{i,t} \leftarrow w_{i,t} \cdot \alpha \quad \forall i \in \text{Industry}_k$
- 28: **end if**
- 29: **end for**
- 30: Normalize remaining weights
- 31: **until** Converged or MaxIterations reached
- 32: *Step 2.3: Untradable Adjustment (Vectorized Logic)*
- 33: $S_{susp} \leftarrow \{i \mid \text{Suspended}_{i,t}\}$
- 34: **if** $t > 0$ **then**
- 35: $w_{i,t} \leftarrow w_{i,t-1} \quad \forall i \in S_{susp}$ ▷ Inherit weight
- 36: $W_{locked} \leftarrow \sum_{i \in S_{susp}} w_{i,t}$
- 37: $w_{j,t} \leftarrow w_{j,t} \cdot (1 - W_{locked}) \quad \forall j \notin S_{susp}$ ▷ Scale tradable
- 38: **end if**
- 39: *Step 2.4: Performance Calculation*
- 40: $R_{gross,t} \leftarrow \sum_i w_{i,t} \cdot r_{i,t}$
- 41: $\text{Turnover}_t \leftarrow \frac{1}{2} \sum_i |w_{i,t} - w_{i,t-1}|$ ▷ Exact turnover cost
- 42: $R_{net,t} \leftarrow R_{gross,t} - \text{Turnover}_t \cdot \gamma$
- 43: **end for**

// Phase 3: Analysis

- 44: $M \leftarrow \text{CalculateMetrics}(R_{net})$ ▷ Annual Ret, IR, MDD, etc.
- 45: **return** M
