Factor(alpha) decay framework

1. Testing Correlation Between Factors and Future Returns

- **IC and IR Values**

$$IC_n = \mathrm{cor}(Factor_t, Ret_{t+1+n})$$

  - **IC Value**: Measures the correlation between a factor and future returns. A high IC value indicates a strong correlation between the factor and future returns.
  - **IC Decay**: Observes changes in IC values over time to assess the stability of a factor. If the IC value decays slowly, it suggests that the factor is relatively stable and suitable for long-term investment; rapid decay may be more suitable for short-term trading.
  - **Half-life**: Defined as the time it takes for the IC value to decay to half, calculated by measuring the IC value of the factor against future returns for several periods.

2. Multi-Factor Model Analysis

- **Feature Contribution**: Analyzes the contribution of each factor to the predictive power of the model.

3. Factor Crowding

- **Valuation Spread**

$$Valuation\ Spread = log(\frac{因子多头估值}{因子空头估值})$$

  - Describes the difference in valuation levels between the long and short ends caused by capital chasing a particular factor.
  - A large valuation spread may lead to a return reversal in the medium to long term.
- **Pairwise Correlation**

$$Pairwise\ Correlation = mean(\sum_{i=1}^{N} corr(r_{多头}, r_{多头,i})) - mean(\sum_{i=1}^{N} corr(r_{空头}, r_{空头,i}))$$

  - Measures the tendency of stocks to move in unison, reflecting the degree of crowding of the factor.
  - Over time, the negative correlation between pairwise correlation and factor returns may weaken or even become positive.

- **Long-term Return Reversal**
  - Most factors show a negative correlation between long-term accumulated returns and future returns.
- **Factor Volatility**

$$Factor\ Volatility = \frac{vol(r_{多头})}{vol(r_{空头})}$$

  - High volatility in a factor may indicate a positive correlation between its returns and the volatility of future factor returns.

4. Long/Short Volatility Ratio

- **Relationship with Future Returns**
  - The relationship between the long/short volatility ratio and future returns of a factor is generally negative, meaning that factors with a high volatility ratio may have lower future returns.
  - There is a significant positive correlation between the long/short volatility ratio and the volatility of future returns of the factor.

5. Factor Timing

- **Optimal Entry and Exit Points**
  - Utilizes various statistical and machine learning techniques to determine the best timing for entering and exiting positions based on factor performance cycles and market conditions.
- **Predictive Signals**
  - Develops predictive signals that anticipate shifts in factor effectiveness, potentially enabling preemptive adjustments to investment strategies.

6. Rolling test effectiveness

- **Window Analysis**
  - Employs rolling windows of historical data to test the robustness and consistency of factor performance over different market periods.
- **Adaptability Assessment**
  - Evaluates how well factors adapt to changing market conditions, providing insights into their reliability and potential decay in effectiveness over time.