

FLOWTRADE

A Momentum Driven Strategy
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OVERVIEW

This is a **momentum-based trading strategy** implemented in Python, using historical stock data to generate buy and sell signals based on the Sharpe ratio. The strategy aims to allocate a portion of the portfolio to a stock when its momentum is positive and reduce exposure when its momentum is negative. This strategy also incorporates performance metrics like **CAGR** (Compound Annual Growth Rate), **Maximum Drawdown**, **Sharpe Ratio**, and **Probabilistic Sharpe Ratio (PSR)**.

STRATEGY LOGIC

The core of this strategy revolves around two key components:

1. **Momentum Calculation:** The strategy calculates momentum based on the Sharpe ratio of returns over two different time periods (n days and $2n$ days). A combined momentum score (average of the two Sharpe ratios) determines whether the strategy should enter or exit positions.
2. **Signal Generation:** A **Signal** is generated based on momentum, indicating when to buy or sell an asset:
 - **Buy Signal (Long Position):** If the momentum score is positive and the portfolio is not fully allocated, the strategy takes a long position.
 - **Sell Signal (Exit or Short Position):** If the momentum score is non-positive and there is an existing position, the strategy reduces or closes the position.

ENTRY AND EXIT RULES

ENTRY RULE (LONG POSITION)

1. **Buy Signal:** The strategy generates a **buy signal** when the momentum score is greater than zero. This happens when the combined Sharpe ratio (calculated from two periods) is positive, indicating strong momentum.
 - The system allocates a portion of the portfolio to the asset. The **tranche size** is a proportion of the total capital, and the strategy ensures that no more than 100% of the portfolio is allocated at any time.
 - **Threshold:** The buy signal will only be triggered if there is available capital (i.e., the portfolio is not fully allocated).

EXIT RULE (CLOSE OR REDUCE POSITION)

2. **Sell Signal:** The strategy generates a **sell signal** when the momentum score is less than or equal to zero. This indicates negative momentum, and the strategy reduces or completely closes the position.
 - If the momentum score turns negative, the position is reduced or exited by the tranche size.

KEY COMPONENTS IN CODE

1. Signal Generation (`generate_signals`):

- This function computes the **Sharpe ratios** for two periods: a short period (n days) and a long period (2n days).
- The **momentum score** is then computed as the average of the two Sharpe ratios.
- Signals are generated based on this momentum score:
 - **Positive momentum** leads to a **buy signal**.
 - **Negative momentum** leads to a **sell signal**.

2. Portfolio Calculation (`calculate_portfolio`):

- Based on the generated signals, positions are tracked, and the portfolio value is computed.
- The **CAGR** (Compound Annual Growth Rate) and **Maximum Drawdown** are calculated as performance metrics to assess the strategy's effectiveness.

3. Performance Metrics (`calculate_metrics`):

- **Sharpe Ratio** for the strategy is calculated to measure risk-adjusted returns.
- The **Sharpe Ratio for Nifty** is used as a benchmark.
- **Win ratio**, **average gain on winning trades**, and **average holding period** are also calculated to assess strategy performance.

4. Probabilistic Sharpe Ratio (PSR):

- This metric provides a probability distribution of the Sharpe ratio, comparing the observed Sharpe ratio to the Nifty benchmark Sharpe ratio.
- The **PSR** is calculated using the error function (erf), which measures the deviation of the strategy's Sharpe ratio from the Nifty Sharpe ratio, normalized by the standard error.

PERFORMANCE METRICS

1. CAGR (Compound Annual Growth Rate):

- Measures the annual growth rate of the portfolio.

2. Maximum Drawdown:

- The largest peak-to-trough loss in the portfolio's value.

3. Sharpe Ratio:

- The Sharpe ratio for both the strategy and the benchmark (Nifty) are calculated to assess risk-adjusted returns.

4. Probabilistic Sharpe Ratio (PSR):

- Provides a probabilistic interpretation of the Sharpe ratio using the error function (erf).

EXAMPLE WORKFLOW

1. **Load Data:** The historical stock data for Nifty is loaded from a CSV file containing the 'Close' prices.
2. **Preprocess Data:** The date is parsed, and the data is cleaned (e.g., handling missing or invalid values).
3. **Generate Signals:** The strategy calculates the Sharpe ratio for two different periods (n and 2n days), computes the momentum score, and generates buy/sell signals based on the momentum score.
4. **Portfolio Calculation:**
 - Portfolio values are tracked based on the generated signals.
 - **CAGR** and **Maximum Drawdown** are calculated.
5. **Performance Evaluation:**
 - The number of trades, win ratio, average gains, and holding period are calculated.
 - The **Sharpe ratio** for both the strategy and the benchmark (Nifty) is computed.
6. **Display Results:**
 - A table of performance metrics is displayed.
 - An equity curve (plot of portfolio value) is visualized.
 - **Probabilistic Sharpe Ratio** is shown in an expandable section to provide further insight into the strategy's performance.

CONCLUSION

This strategy uses a momentum-based approach driven by Sharpe ratios, which measure risk-adjusted returns. By allocating portions of the portfolio based on momentum, the strategy aims to maximize returns while controlling risk. The use of the **Probabilistic Sharpe Ratio (PSR)** allows for a deeper understanding of how the strategy performs relative to the benchmark, providing a more nuanced view of performance under uncertainty.