FLOWTRADE

A Momentum Driven Strategy

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.