**Updated Strategy Description**

The updated strategy incorporates a **dynamic window approach** with a size of 5 rows for prediction and hedging. Here's a detailed explanation:

**1. Strategy Overview**

The goal of the strategy is to dynamically hedge an option portfolio by adjusting the position in the underlying asset based on Delta values. The addition of a **dynamic window** enables periodic re-evaluation of the option's predicted price and hedging parameters, enhancing adaptability to changing market conditions.

**2. Key Components**

**Implied Volatility (IV)**

* **Role**: IV is calculated for each option using the Black-Scholes pricing model and serves as a critical input for predicting option prices and calculating Delta.
* **Dynamic Adaptation**: The IV reflects market expectations of future volatility and is recalculated within each window, ensuring the strategy stays aligned with current market conditions.

**Crank-Nicholson Method**

* **Role**: The CN method solves the Black-Scholes PDE numerically to calculate option prices, including the predicted option price and Delta.
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  Description automatically generated**Delta Calculation**: CN is used to compute the option value for slightly higher and lower prices of the underlying asset. The difference is used to calculate Delta:

**Dynamic Window of 5 Rows**

* **Purpose**: The strategy processes 5 rows of data at a time. Within each window:
  + Predicted prices and Delta values are recalculated.
  + Portfolio adjustments are made based on the calculated Delta.
* **Flexibility**: By using a rolling window approach, the strategy can handle high-frequency data while maintaining a manageable computational load.

**3. Workflow**

**Step 1: Data Segmentation**

* The dataset is divided into overlapping windows of 5 rows.
* Each window represents a time frame for which predictions and hedging adjustments are made.

**Step 2: Prediction and Hedging**

* For each row within the window:
  1. **IV Calculation**:
     + Using the market option price, the implied volatility is derived.
  2. **Option Price Prediction**:
     + The CN method calculates the predicted option price for the current market conditions.
  3. **Delta Calculation**:
     + Using the CN method, Delta is computed to assess sensitivity to underlying price changes.
  4. **Position Adjustment**:
     + The portfolio’s Delta-neutral position is updated by buying/selling the appropriate number of underlying shares.
  5. **Portfolio Value Update**:
     + The total portfolio value is recorded, including the cash balance and underlying asset position.

**Step 3: Risk Metrics**

* After processing all windows, the following metrics are calculated:
  1. **Volatility**: Measures the variability of portfolio returns.
  2. **Maximum Drawdown**: Indicates the largest decline in portfolio value from its peak.

**4. Benefits of the Updated Strategy**

1. **Improved Adaptability**:
   * The rolling window approach ensures frequent recalibration of hedging parameters, making the strategy more responsive to market changes.
2. **Enhanced Prediction**:
   * By recalculating predicted option prices and Delta values within each window, the strategy ensures that hedging decisions are based on the most recent market data.
3. **Risk Management**:
   * Regular updates of positions help minimize residual risks from market movements, maintaining a robust Delta-neutral hedge.
4. **Computational Efficiency**:
   * Processing data in smaller, manageable windows allows for real-time adjustments without excessive computational burden.

**5. Outputs**

* **Predicted Option Prices**:
  + A table of predicted prices for each row of data, derived using the CN method.
* **Portfolio Performance**:
  + The portfolio value is tracked dynamically across all windows.
* **Risk Metrics**:
  + Volatility and maximum drawdown provide quantitative assessments of the strategy's risk control effectiveness.

This updated approach strikes a balance between accuracy and computational efficiency, making it suitable for high-frequency trading scenarios.