# Strategy Description

**Model Description**

The **Jump-Diffusion Model** enhances the classical Black-Scholes framework by incorporating jumps to better reflect real-world market dynamics, where large, sudden price movements are common. The model consists of two components:

1. **Diffusion Component**:
   * This represents the continuous price movement driven by a standard Brownian motion.
   * Captures the normal fluctuations in asset prices.
2. **Jump Component**:
   * Modeled as a Poisson process with a certain jump intensity (λ), which represents the average number of jumps per unit time.
   * Each jump size is modeled as a log-normal distribution 
   * This component allows the model to capture sudden, large price movements (e.g., earnings announcements, macroeconomic events).

The combined dynamics of the Jump-Diffusion Model for the asset price ​ are as follows:

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**Strategy Description**

**Objective**

The **Dynamic Hedging Strategy with Risk Management** aims to minimize portfolio risks arising from Delta and Gamma exposures while capturing opportunities presented by price jumps.

**Core Components**

1. **Dynamic Hedging**:
   * Rebalances the portfolio continuously to maintain Delta neutrality, i.e., , reducing directional risk.
   * Gamma exposure is monitored to minimize risks from non-linear price movements.
2. **Risk Management**:
   * Controls excessive adjustments to Delta and Gamma by enforcing predefined thresholds.
   * Ensures that trading activity remains within acceptable limits to avoid overtrading or incurring high transaction costs.
3. **Real-Time Monitoring**:
   * Tracks asset prices, recalculates Greeks (Delta and Gamma), and adjusts hedging positions based on the Jump-Diffusion Model's simulated price paths.

**Key Features**

* **Delta and Gamma Exposure Control**:
  + Limits the maximum change in Delta per time step 
  + Caps absolute Gamma exposure
  + 
* **Continuous Adjustment**:
  + Adjusts portfolio positions dynamically to maintain risk limits and respond to market fluctuations.
* **Efficient Cost Management**:
  + Reduces transaction costs and avoids market impact by minimizing unnecessary trades.

**Process**

1. **Model Initialization**:
   * Simulate asset prices using the Jump-Diffusion Model.
   * Set up parameters such as drift (μ, volatility (σ), jump intensity (λ), and jump size distribution.
2. **Calculate Greeks**:
   * Use the Black-Scholes formula to compute Delta (Δ and Gamma (Γ,Gamma) for the given asset price and option parameters.
3. **Hedging Execution**:
   * Continuously rebalance the portfolio to maintain Delta neutrality.
   * Ensure Gamma exposure remains within risk limits.
4. **Monitor and Cap Risks**:
   * Restrict adjustments to Delta and Gamma if they exceed the predefined thresholds.
   * Log any adjustments that are capped to prevent excessive trading.
5. **Profit Realization**:
   * Close positions when the hedging goal is achieved or at maturity, ensuring profits are locked.

**Advantages**

1. **Enhanced Realism**:
   * The Jump-Diffusion Model reflects real-world market behaviors, capturing sudden price movements that classical models ignore.
2. **Risk Reduction**:
   * By controlling Delta and Gamma exposures, the strategy minimizes the portfolio's sensitivity to both directional and convex risks.
3. **Cost Efficiency**:
   * Limits unnecessary adjustments, reducing transaction costs and avoiding market impact.
4. **Adaptability**:
   * Dynamically adjusts to changing market conditions while maintaining robust risk controls.