Pattern Agent

Pattern Recognition

Identified Pattern:

The chart appears to show a **Double Bottom** pattern. Here's the reasoning:

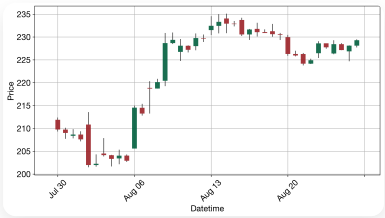
1. **Structure**: The chart shows two distinct low points around the beginning of August, with a rebound in between, forming a 'W' shape.
2. **Trend**: Before the pattern, there is a downtrend, which is typical before a Double Bottom. After the second low, the price rises, indicating a potential reversal.
3. **Symmetry**: The two low points are relatively similar in price, which is characteristic of a Double Bottom.

This pattern typically suggests a reversal from a downtrend to an uptrend.

Pattern Reliability:

Descending triangle has a high success rate for bearish continuation patterns. Key support level at 110,000.

Pattern Visualization



Desc Triangle Overlay

Trend Agent

Trend Analysis

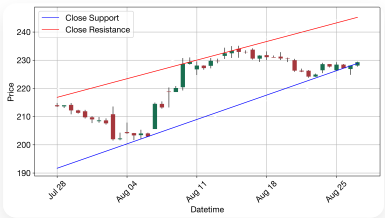
Trend Strength Indicators:

- **ADX:** 28.5 - Moderate trend strength
- **RSI Divergence:** Positive divergence detected
- **Momentum:** Declining momentum indicators
- **Volume:** Decreasing volume on rallies

Likely Downtrend Signal:

Consistent downward slope and inability to break resistance suggest continued bearish pressure. Short-term trend likely to continue downward.

Trend Visualization



Support & Resistance Lines

Figure 12 Pattern and trend report generated by QuantAgent. The top panel presents a detected Double Bottom pattern, supported by structural symmetry, a preceding downtrend, and subsequent rebound. The accompanying chart overlay highlights the pattern geometry. The bottom panel provides trend diagnostics, including ADX, RSI divergence, and volume analysis, alongside a visualization of support and resistance levels. Together, the pattern and trend modules offer complementary perspectives on potential trend reversal and market recovery.

E Benchmark Detail

E.1 Benchmark Construction

To evaluate the proposed QuantAgent framework, we design a benchmark composed of diverse, well-known financial assets. This benchmark allows us to systematically test the system's ability to generalize across asset classes and trading environments. The benchmark also facilitates controlled comparisons across different decision-making models and enables reproducibility.

E.2 Data Collection and Asset Selection

All historical price data used in the benchmark are obtained via the publicly available APIs, specifically YFinance and TradingView's historical market data services. We use 1-hour and 4-hour OHLC (Open, High, Low, Close) candlestick data for all assets to maintain consistency in time resolution. The benchmark covers a diverse mix of asset types, including cryptocurrency (BTC/USD), crude oil (CL), equity index futures (ES and NQ), and exchange-traded or spot indices such as QQQ, SPX, DJI, and VIX. Each asset is widely traded and highly liquid, helping avoid noise from low trading activity and making sure the price movements reflect real market behavior. Besides, the selected assets include both relatively stable, trend-following instruments such as SPX and ES, which often exhibit smoother directional movement, and more volatile assets such as BTC/USD, which are known for rapid swings and high short-term variability.

For each asset, we collect 5,000 historical 1-hour and 4-hour bars. To ensure fairness and consistency across assets, we apply the same fixed bar count to all instruments—including those with limited trading hours, such as QQQ. As a result, assets with lower intraday trading frequency span a longer historical period (up to ten years), reflecting the reduced density of available candlestick intervals. From this data, we randomly sample 100 evaluation segments per asset. Each segment consists of 100 consecutive candlesticks, with the final 3 candlesticks removed during inference to ensure the system does not observe the true market outcome during prediction. The final three candlesticks are reserved for validating the correctness of the LLM's prediction.

E.3 Benchmark Asset Properties

Asset	Market Type	Start Date	End Date	Total Bars
BTC/USD	Cryptocurrency	2023-04-01	2025-06-23	5000
CL (Crude Oil)	Commodity Futures	2022-04-25	2025-06-19	5000
DJI	Equity Index (Spot)	2015-08-26	2025-05-16	5000
ES (S&P 500)	Equity Index Futures	2022-04-19	2025-06-19	5000
NQ (Nasdaq)	Equity Index Futures	2022-04-19	2025-06-19	5000
QQQ	Equity ETF	2015-08-24	2025-05-16	5000
SPX	Equity Index (Spot)	2015-08-25	2025-05-16	5000
VIX	Volatility Index (CBOE)	2020-10-20	2025-08-27	5000

Table 2 Overview of 4-hour benchmark asset properties. Each asset is characterized by its name, market type, the start and end dates of the data collection window, and the total number of bars sampled.

Asset	Market Type	Start Date	End Date	Total Bars
BTC/USD	Cryptocurrency	2025-02-21	2025-09-13	5000
CL (Crude Oil)	Commodity Futures	2024-11-12	2025-09-10	5000
DJI	Equity Index (Spot)	2022-11-14	2025-09-02	5000
ES (S&P 500)	Equity Index Futures	2024-11-11	2025-09-10	5000
NQ (Nasdaq)	Equity Index Futures	2024-11-11	2025-09-10	5000
QQQ	Equity ETF	2022-11-14	2025-09-02	5000
SPX	Equity Index (Spot)	2022-11-14	2025-09-02	5000
DAX	Equity Index (Futures)	2024-10-21	2025-09-22	5000

Table 3 Overview of 1-hour benchmark asset properties. Each asset is characterized by its name, market type, the start and end dates of the data collection window, and the total number of bars sampled.

E.4 Benchmark Assets Detail

We evaluate our models on a diverse set of benchmark assets drawn from major areas of the global financial markets.

BTC/USD (Bitcoin) shows how much one Bitcoin is worth in U.S. dollars. It represents the broader cryptocurrency market and operates continuously with high trading volume.

CL (Crude Oil) tracks the price of West Texas Intermediate crude oil, a key benchmark for U.S. energy prices and a global indicator influenced by supply, demand, and geopolitical factors.

ES (E-mini S&P 500) is a futures contract tied to the S&P 500 Index, which includes 500 large publicly traded U.S. companies. It gives a broad picture of the U.S. stock market's performance.

NQ (E-mini Nasdaq-100) follows the Nasdaq-100 Index, which focuses on large non-financial companies listed on the Nasdaq exchange, especially in the technology and innovation sectors.

QQQ is an exchange-traded fund (ETF) that aims to match the performance of the Nasdaq-100 Index. It offers a simple way for investors to gain exposure to major U.S. tech and growth stocks.

SPX (S&P 500 Index) directly tracks the S&P 500 Index and is widely used as a benchmark for measuring the overall performance of U.S. equities.

DJI (Dow Jones Industrial Average) includes 30 large and well-known U.S. companies across different industries. It is commonly used as an indicator of the broader U.S. economy.

VIX (Volatility Index) reflects the market's expectation of near-term volatility, often referred to as the "fear gauge" and widely used by investors to assess risk sentiment during periods of market uncertainty.

DAX (DAX Volatility Index) represents the market's expectation of short-term volatility in the German equity market. It is widely monitored by investors to assess risk sentiment and uncertainty surrounding the DAX 40 Index and broader eurozone conditions.

E.5 Conclusion

This benchmark offers a consistent and comprehensive setting for evaluating trading systems across a range of asset classes. By standardizing the data resolution and segment format, it ensures fair and reproducible comparisons while still capturing the variety found in real-world markets. The inclusion of both stable, trend-following assets and more volatile instruments enables meaningful stress testing of model performance within multi-agent high-frequency trading frameworks like QuantAgent.

F Case Studies

When presented with the unannotated K-line window in Figure 4, the Pattern Agent first extracts swing pivots from recent bars and ranks successive local highs. The resulting pivot sequence forms a monotonic decline; a least-squares fit through those highs yields a negatively sloped resistance trajectory. In parallel,