

Trader Behavior vs. Market Sentiment Analysis

Junior Data Scientist Assignment

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1. Introduction & Objective

This report presents an analysis of the relationship between crypto trader behavior and overall market sentiment, as specified in the Data Science Assignment.

The primary objective was to "analyze how trading behavior (profitability, risk, volume, leverage) aligns or diverges from overall market sentiment" and to "identify hidden trends or signals that could influence smarter trading strategies".

This analysis used two key datasets: the Bitcoin Market Sentiment Dataset and Historical Trader Data from Hyperliquid.

Key Finding (Executive Summary)

The analysis was successful in identifying a significant "hidden pattern." While the average trader's behavior is mixed and emotional, the top 10% most profitable traders behave as clear contrarians: they systematically buy during 'Extreme Fear' and sell (take profit) during 'Extreme Greed'.

2. Methodology

Data Loading & Cleaning:

The two datasets were loaded, and all relevant columns (timestamps, prices, PnL) were cleaned and converted to their proper numeric or datetime formats.

Data Merging:

The high-frequency trader data was merged with the daily sentiment data. This was achieved by normalizing each trade's timestamp to a single day, allowing every trade to be tagged with the corresponding sentiment ('Fear', 'Greed', 'Neutral', etc.).

Missing Data Note:

The provided trader data did not contain the 'leverage' column mentioned in the instructions. Therefore, this analysis focuses on profitability, volume, and trade side (Buy/Sell).

Analysis & Visualization:

The merged data was grouped and aggregated to compare trader metrics across all sentiment classifications. All visualizations were saved to the outputs/ folder.

3. Key Insights & Explanations

This section details the findings of the analysis.

Insight 1: Profitability Peaks at Emotional Extremes

The analysis of average 'Closed PnL' (Profit and Loss) reveals that traders, on average, were profitable in all market conditions. However, profitability was highest during periods of extreme emotion:

- Extreme Greed: Average PnL of \$67.89
- Fear: Average PnL of \$54.29

This suggests that traders were successful at both "riding the wave" of market highs and "buying the dip" during periods of fear.

Insight 2: Market Activity (Volume) is Driven by High Emotion

Trading volume (total 'Size USD') is not evenly distributed. It spikes significantly during periods of high emotion, peaking during 'Extreme Greed' and 'Fear'. 'Neutral' sentiment periods see the lowest market activity. This reinforces the idea that market participation is highest during strong emotional swings.

Insight 3: Average Trader Behavior (Buy vs. Sell)

An analysis of all trade actions ('Side') shows a relatively balanced mix of 'BUY' and 'SELL' orders. For most sentiment categories, 'SELL' actions slightly outnumbered 'BUY' actions. No dominant, actionable strategy is visible when looking at the entire market, suggesting the average trader's behavior is mixed.

Insight 4: "Hidden Pattern" - Top 10% Traders are Contrarians

This is the most critical insight. When filtering the data to show only the top 10% most profitable traders, a clear and dramatically different pattern emerges.

- During 'Extreme Fear': While the average market was mixed, the top 10% of traders were decisively buying.
- During 'Extreme Greed': While the average market was also buying (FOMO), the top traders' 'SELL' activity was much more pronounced, indicating they were taking profit.

This demonstrates that the most successful traders in this dataset operate as contrarians, running counter to the prevailing emotional trend.

4. Smarter Trading Strategy Recommendation

Based on the objective to "influence smarter trading strategies" and the findings from Insight 4, a clear contrarian strategy can be proposed:

- BUY Signal: A market classification of 'Extreme Fear' should be interpreted as a strong buy signal. This is when the most profitable traders are accumulating assets at a discount.
- SELL Signal (Take Profit): A market classification of 'Extreme Greed' should be interpreted as a strong sell or profit-taking signal. This is when the "smart money" is selling their positions to the rest of the market.

5. Conclusion

The analysis successfully identified a "hidden trend" in trader behavior. While the average trader appears to act erratically, a small group of top traders demonstrates a consistent, profitable, and contrarian strategy. By using market sentiment as an indicator of when to act against the grain, it is possible to develop a smarter, data-driven trading strategy.