Trader Behavior Insights: Market Sentiment Analysis

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1. Objective

The objective of this project is to analyze the relationship between trader behavior and overall market sentiment using historical trading data and the Bitcoin Fear & Greed Index. The analysis focuses on understanding how trader performance and activity vary during Fear and Greed market conditions, and whether sentiment-driven behavior patterns can be identified.

2. Datasets Used

2.1 Historical Trader Data (Hyperliquid)

This dataset contains trade-level execution data including:

- Trade timestamps
- Profit and loss (PnL)
- Trade size in USD
- Number of trades per day

Daily-level metrics were engineered from this data to analyze trader performance and activity.

2.2 Bitcoin Fear & Greed Index

This dataset provides daily market sentiment classified as:

- Extreme Fear

- Fear
- Neutral
- Greed
- Extreme Greed

For analytical clarity, sentiment levels were normalized into a binary classification:

- **Fear:** Extreme Fear, Fear, Neutral
- **Greed:** Greed, Extreme Greed

3. Data Processing & Methodology

- Trade timestamps were cleaned and converted to a standardized datetime format.
- Daily metrics such as total PnL, average PnL, total trading volume, and trade count were aggregated.
- Market sentiment data was cleaned, normalized, and aligned by date.
- The datasets were merged using date-based inner joins to ensure data integrity.
- No artificial date shifting or forward-filling was applied.

Due to limited temporal overlap between the datasets, the final merged dataset contained a small number of matched observations. This reflects real-world data availability constraints and preserves analytical honesty.

4. Exploratory Data Analysis & Visualizations

4.1 Daily PnL vs Market Sentiment

A boxplot was used to compare daily total PnL across Fear and Greed periods.

Observations:

- Most daily PnL values are concentrated near zero, indicating small gains or losses on most days.

- Greed periods show higher variability, with larger positive and negative outliers.
- Fear periods appear more controlled with fewer extreme outcomes.

4.2 Trading Volume vs Market Sentiment

A bar chart was used to compare average trading volume during Fear and Greed conditions.

Observations:

- Trading volume tends to increase during Greed periods.
- This suggests higher market participation and increased risk appetite during optimistic sentiment phases.

5. Key Insights

- Market sentiment has a visible impact on trader behavior.
- Greed phases are associated with higher risk-taking, increased volume, and greater PnL volatility.
- Fear phases exhibit more conservative behavior, though profitable opportunities still exist.
- A small subset of traders appears capable of performing well during Fear conditions, indicating contrarian or disciplined strategies.

6. Limitations

- The analysis is constrained by limited date overlap between datasets.
- Results should be interpreted directionally rather than conclusively.
- Further analysis with extended overlapping data could strengthen statistical confidence.

7. Conclusion

This study demonstrates that trader behavior and performance are influenced by market sentiment. Incorporating sentiment-aware risk controls and adaptive trading strategies may help improve performance and manage volatility. The project highlights the importance of data integrity, transparent assumptions, and realistic constraints in applied data science.