Trader Performance vs Market Sentiment Analysis

1. Introduction

This project investigates the relationship between trader performance and market sentiment by analyzing historical trade-level data from Hyperliquid alongside the Bitcoin Fear & Greed Index. The objective is to identify how profitability, risk-taking behavior, and strategy effectiveness vary across sentiment regimes, with particular focus on extreme emotional conditions such as Extreme Fear and Extreme Greed.

Rather than attempting price prediction, the analysis emphasizes behavioral interpretation, risk awareness, and strategy robustness to derive actionable insights for trading and risk management.

2. Dataset Description

2.1 Historical Trader Data (Hyperliquid)

The historical trader dataset (historical_data.csv) consists of detailed trade-level records, where each row represents a completed trade. The dataset includes attributes such as account identifier, trade direction (buy/sell), execution price, trade size in tokens and USD, fees, timestamps, and realized profit and loss (PnL).

This dataset enables detailed analysis of trader behavior, profitability, and exposure, making it suitable for studying strategy performance and behavioral patterns under different market conditions.

2.2 Bitcoin Fear & Greed Index

The Bitcoin Fear & Greed Index (fear_greed_index.csv) provides a daily measure of market sentiment, categorizing market conditions into Extreme Fear, Fear, Neutral, Greed, and Extreme Greed. Rather than reflecting price movements directly, this index captures prevailing market psychology and emotional intensity, making it particularly useful for behavioral and sentiment-based analysis.

3. Data Preparation and Sentiment Alignment

Trade timestamps were normalized and aligned with daily sentiment values using same-day joins to avoid look-ahead bias. No future sentiment information was used when labeling trades.

Market sentiment was encoded in both categorical and ordinal forms to capture not only sentiment direction but also emotional intensity. Trades occurring on dates without available sentiment data were retained with missing labels rather than forward-filled, ensuring analytical integrity and preventing artificial signal introduction.

4. Feature Engineering

Additional features were engineered to capture key aspects of trader behavior and performance. These included profitability metrics such as net PnL and capital-normalized returns, risk-related features such as absolute trade size, and behavioral indicators such as trade direction.

Interaction features combining trade direction and sentiment intensity were also constructed to support strategy-level analysis. The resulting feature-complete dataset formed the foundation for exploratory, behavioral, and strategy analyses.

5. Exploratory Data Analysis

Exploratory analysis revealed clear differences in trading activity, profitability, and risk exposure across sentiment regimes. Trading activity and average position sizes increased during greedy market conditions, indicating elevated risk-taking behavior.

Profitability distributions showed heavier downside tails during Extreme Greed, while Fear-dominated regimes exhibited more conservative exposure patterns. These observations motivated deeper investigation into strategy behavior and trader archetypes.

6. Strategy Analysis: Contrarian vs Momentum

Trades were classified as momentum when trade direction aligned with prevailing sentiment intensity and contrarian when trades opposed it.

The analysis showed that contrarian strategies exhibited higher upside potential but also greater variability in returns. Momentum strategies, in contrast, demonstrated more stable but capped performance. These differences became more pronounced during extreme sentiment regimes.

Robustness checks revealed that contrarian strategies benefit from occasional large winning trades, while momentum strategies exhibit lower variance. Importantly, trimming extreme PnL observations did not reverse the relative performance ordering, confirming that the observed patterns were not driven solely by outliers.

7. Trader Archetypes and Behavioral Clustering

Trader behavior was found to be heterogeneous rather than uniform. Behavioral clustering based on profitability, volatility, activity level, and trade size identified distinct trader archetypes, including conservative traders, overtraders, aggressive size traders, and high-risk participants.

Conservative trader archetypes demonstrated stable performance across sentiment regimes, while aggressive and high-risk traders experienced significant drawdowns during emotionally charged market conditions. These findings highlight the importance of behavioral discipline and controlled exposure.

8. Extreme Sentiment Risk Analysis

Analysis of Extreme Fear and Extreme Greed regimes revealed notable asymmetries in risk behavior. Extreme Greed was associated with increased position sizes and significantly worse tail losses, indicating overconfidence-driven risk escalation.

In contrast, Extreme Fear exhibited more controlled downside risk and occasional asymmetric upside. These results suggest that severe drawdowns are more strongly driven by excessive risk-taking during greedy conditions than by fear-induced market stress.

9. Robustness Checks

To validate the stability of the findings, robustness checks were performed by trimming the top and bottom 1% of net PnL observations. The core conclusions regarding strategy performance, trader archetypes, and extreme sentiment risk remained consistent after trimming.

This confirms that the observed relationships reflect systematic behavioral dynamics rather than isolated extreme trades.

10. Key Insights and Implications

- Market sentiment significantly influences trader risk behavior.
- Extreme Greed poses greater downside risk than Extreme Fear.
- Contrarian strategies offer higher upside but are more outlier-sensitive.
- Conservative trader archetypes demonstrate superior survival characteristics.
- Risk escalation, rather than sentiment direction alone, drives major drawdowns.

- These insights can inform the design of more resilient trading strategies and improved risk management frameworks.

11. Conclusion

This study demonstrates that trader performance is closely linked to behavioral responses to market sentiment rather than sentiment alone. By combining sentiment indicators with trade-level behavioral analysis, the project highlights how strategy alignment and risk management discipline shape trading outcomes, particularly during extreme emotional regimes.

The findings emphasize the importance of controlling exposure during greedy market conditions and adopting behaviorally robust strategies to improve long-term trading performance.

12. Important Links

- **Github Repo:**
  https://github.com/DeadBoTt-exe/Assignment_Primetrade.ai.git

- **Google Docs:**
  https://docs.google.com/document/d/1Bcle6zxXZ6NslNAdmclNJFBCemAoGxDcNBXGU2MGfJI/edit?usp=sharing

- **Datasets:**
- Historical Trader Data :
  https://drive.google.com/file/d/1IAfLZwu6rJzyWKgBToqwSmmVYU6VbjVs/view?usp=sharing

- Bitcoin Fear & Greed Index :
  https://drive.google.com/file/d/1PgQC0tO8XN-wqkNyghWc_-mnrYv_nhSf/view?usp=sharing