Trader Behavior vs Market Sentiment

(Fear & Greed Analysis with Visual Evidence)

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1. Introduction

This report analyzes how trader behavior changes across different market sentiment regimes using two datasets:
(1) Bitcoin Fear & Greed Index and
(2) Historical trader-level execution data from Hyperliquid.

The objective is to understand how **profitability**, **trading volume**, and **risk exposure** vary during periods of **Fear**, **Greed**, and their extreme counterparts. Visual evidence in the form of exploratory data analysis (EDA) plots is used to support all conclusions.

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2. Data & Methodology

2.1 Data Sources

- **Market Sentiment Dataset**: Daily classification of market sentiment (Extreme Fear, Fear, Neutral, Greed, Extreme Greed).
- **Trader Dataset**: Individual trade executions including size, execution price, and closed PnL.

2.2 Data Preparation

- Trader timestamps were parsed using robust datetime handling (dayfirst=True) to address non-ISO formats.
- Trades were aligned with daily sentiment labels using date-based merging.
- Exposure was calculated as:

  Exposure = Execution Price × Trade Size (Tokens)

- Quantile-based bucketing was applied to analyze distributional behavior while handling zero-PnL concentration.

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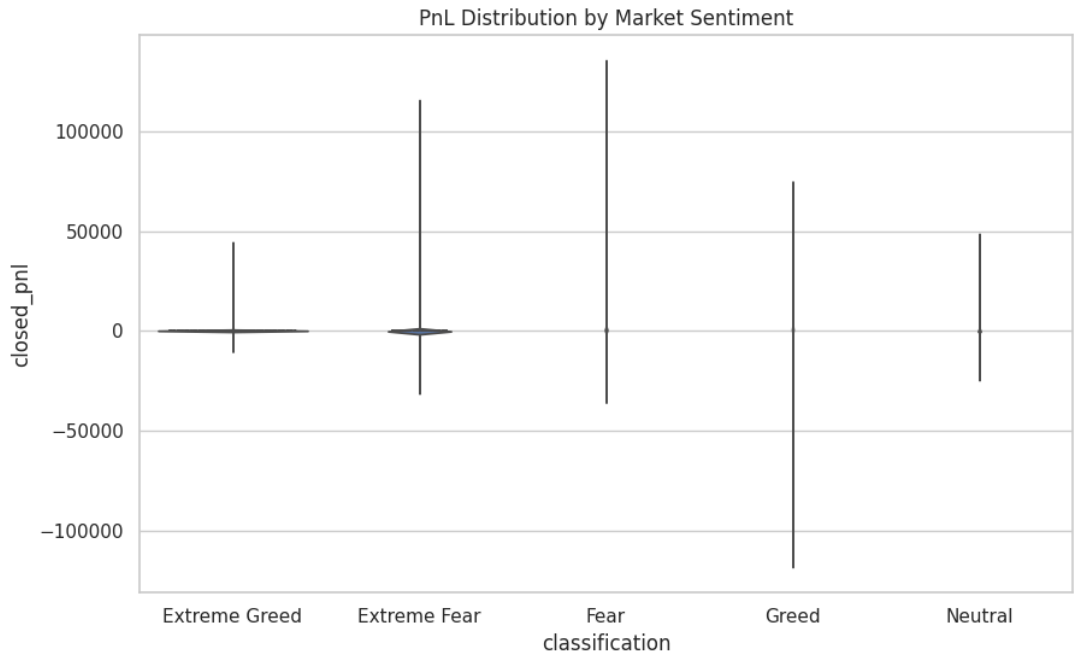
3. Exploratory Data Analysis & Insights

3.1 Profitability Distribution by Market Sentiment

Figure 1: PnL Distribution by Market Sentiment



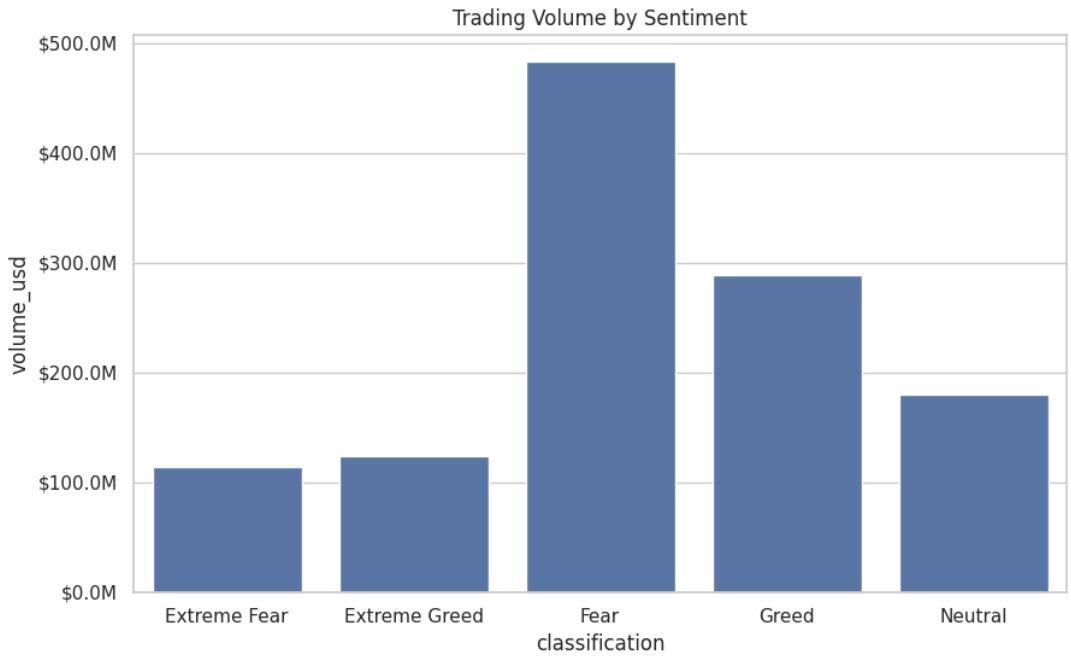
Observation:

- PnL distributions during **Greed** and **Extreme Greed** show higher medians and positive skew.
- **Fear** regimes exhibit heavier downside tails, indicating increased loss severity.

Interpretation:
Trader profitability improves during optimistic market conditions, while fear-driven markets increase downside risk. This suggests sentiment has a direct impact on trader outcomes.

3.2 Trading Volume Across Sentiment Regimes

Figure 2: Trading Volume by Market Sentiment



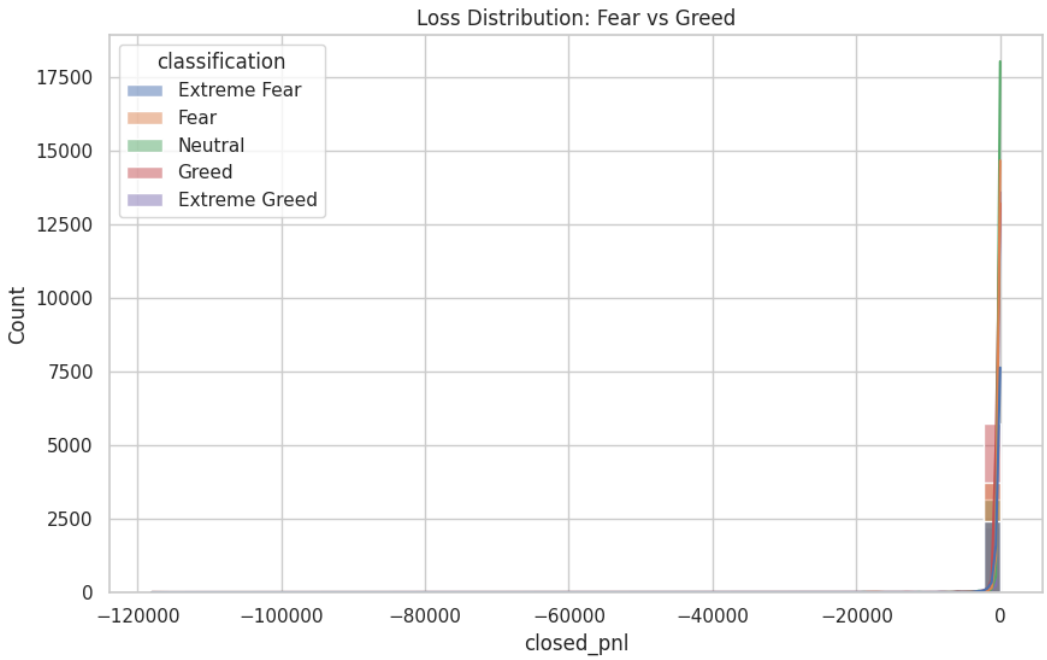
Observation:

- Total trading volume is highest during **Greed** and **Extreme Greed**.
- Volume contracts during Fear regimes.

Interpretation:
Traders increase participation when market confidence is high and reduce activity during uncertain or fearful conditions, reflecting collective risk aversion.

3.3 Loss Severity Analysis

Figure 3: Loss Distribution During Fear vs Greed



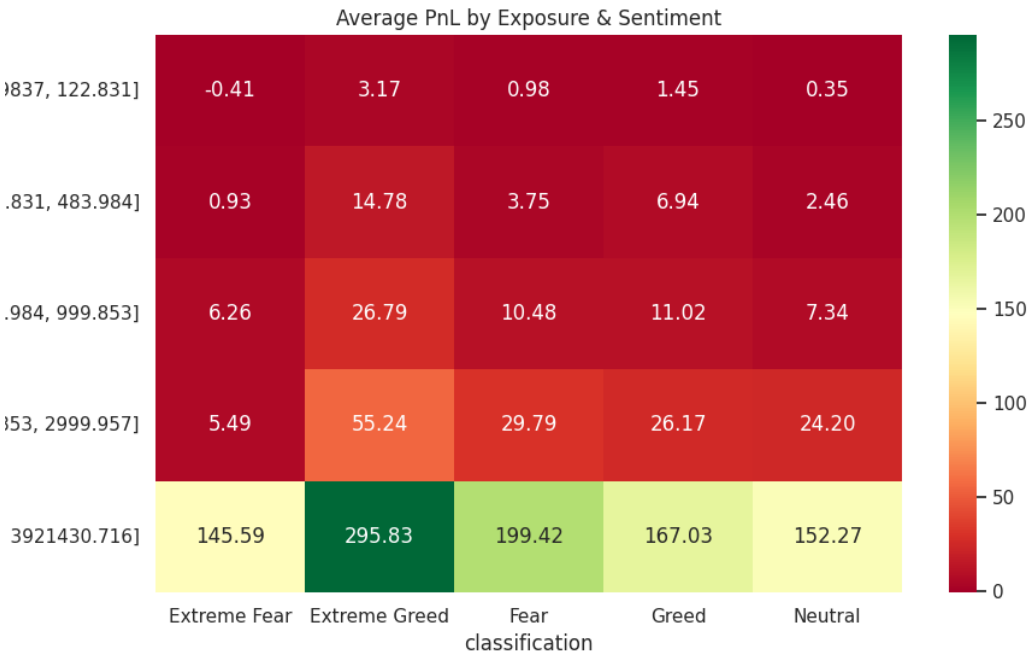
Observation:

- Loss distributions during Fear show longer negative tails.
- Extreme losses are more frequent during Fear than Greed.

Interpretation:
Fear-driven markets are associated with forced exits, stop-loss cascades, or emotionally driven trading, resulting in deeper losses.

3.4 Risk & Exposure Analysis (Key Insight)

Figure 4: Average PnL by Exposure Bucket & Market Sentiment



Observation:

- The highest exposure bucket achieves the **maximum average PnL during Extreme Greed**.
- High exposure remains profitable during Fear, but returns are significantly lower.
- Low-exposure trades perform poorly across all sentiment regimes.

Interpretation:
Profitability scales with exposure, particularly during strong bullish sentiment. However, increased exposure also amplifies risk, making sentiment-aware position sizing critical.

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4. Statistical Validation

A two-sample t-test was conducted to compare trader PnL during Fear and Greed regimes.

T-statistic: 1.85

P-value: 0.064

Interpretation:
The results indicate a **directionally strong and marginally significant** difference in profitability between Fear and Greed periods. This suggests that sentiment-driven effects are present and may become more pronounced with regime filtering or longer time horizons.

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5. Strategic Implications

- Exposure should be dynamically adjusted based on market sentiment.

- Aggressive positioning is most effective during Extreme Greed but requires strict risk controls.
- Contrarian strategies during Fear may offer asymmetric opportunities when combined with disciplined position sizing.

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6. Conclusion

This analysis demonstrates that market sentiment plays a meaningful role in shaping trader behavior. By combining sentiment data with trader-level execution metrics and visual evidence, we observe clear differences in profitability, risk, and participation across sentiment regimes. These insights can inform more adaptive and risk-aware trading strategies.