Trader Behavior vs Market Sentiment Analysis

Fear & Greed Trading Dynamics in Hyperliquid

Data Science Assignment Submission

December 14, 2025

Interactive Analysis Notebook

Google Colab: [View Full Analysis Code](#)

All code cells executed with outputs visible. Access set to "Anyone with the link can view"

Abstract

This report analyzes the relationship between cryptocurrency trader behavior and market sentiment using historical trading data from Hyperliquid (May 2023 - May 2025) merged with the Bitcoin Fear & Greed Index. Through comprehensive statistical analysis of 211,218 trades across 792 days, we identify significant behavioral patterns: traders exhibit higher activity (+17%) and risk-taking (+87%) during Greed periods but demonstrate lower profitability efficiency. Fear periods show concentrated profitability among top traders, while Greed periods display democratized but less efficient returns. These insights provide actionable intelligence for designing sentiment-aware trading strategies.

1 Introduction

Market sentiment significantly influences trader behavior in cryptocurrency markets. This analysis explores how profitability, risk appetite, trading volume, and execution efficiency vary across Fear, Neutral, and Greed market conditions. Understanding these patterns enables:

- Development of sentiment-aware trading algorithms
- Risk management protocol optimization
- Identification of market inefficiency signals
- Strategic position sizing during sentiment extremes

2 Datasets & Methodology

2.1 Data Sources

Bitcoin Fear & Greed Index: Daily sentiment classifications from February 2018 to May 2025 (2,644 observations). Sentiment categories include Extreme Fear, Fear, Neutral, Greed, and Extreme Greed.

Hyperliquid Historical Trader Data: Trade-level execution data from May 2023 to May 2025 containing 211,224 records with execution prices, position sizes, realized PnL, fees, leverage proxies, and timestamps.

2.2 Data Preparation Pipeline

1. **Timestamp Normalization:** Identified multiple timestamp formats in raw data. Used `Timestamp IST` as the reliable execution time, converting all trades to daily granularity.

2. **Sentiment Alignment:** Merged trader data with daily market sentiment on date keys, achieving 99.997% successful matches.

3. **Feature Engineering:**

   - Trade direction indicators (buy/sell flags)
   - Profitability signals (PnL ¿ 0)
   - Risk ratio: Risk Ratio $= \frac{\text{Trade Volume USD}}{|\text{Start Position}|+1}$
   - Sentiment grouping: collapsed 5 categories into Fear, Neutral, Greed

4. **Quality Assurance:** Removed 6 records with missing sentiment (0.003% of data).

   Final Dataset: 211,218 clean trades across 792 trading days (May 2023 - May 2025).

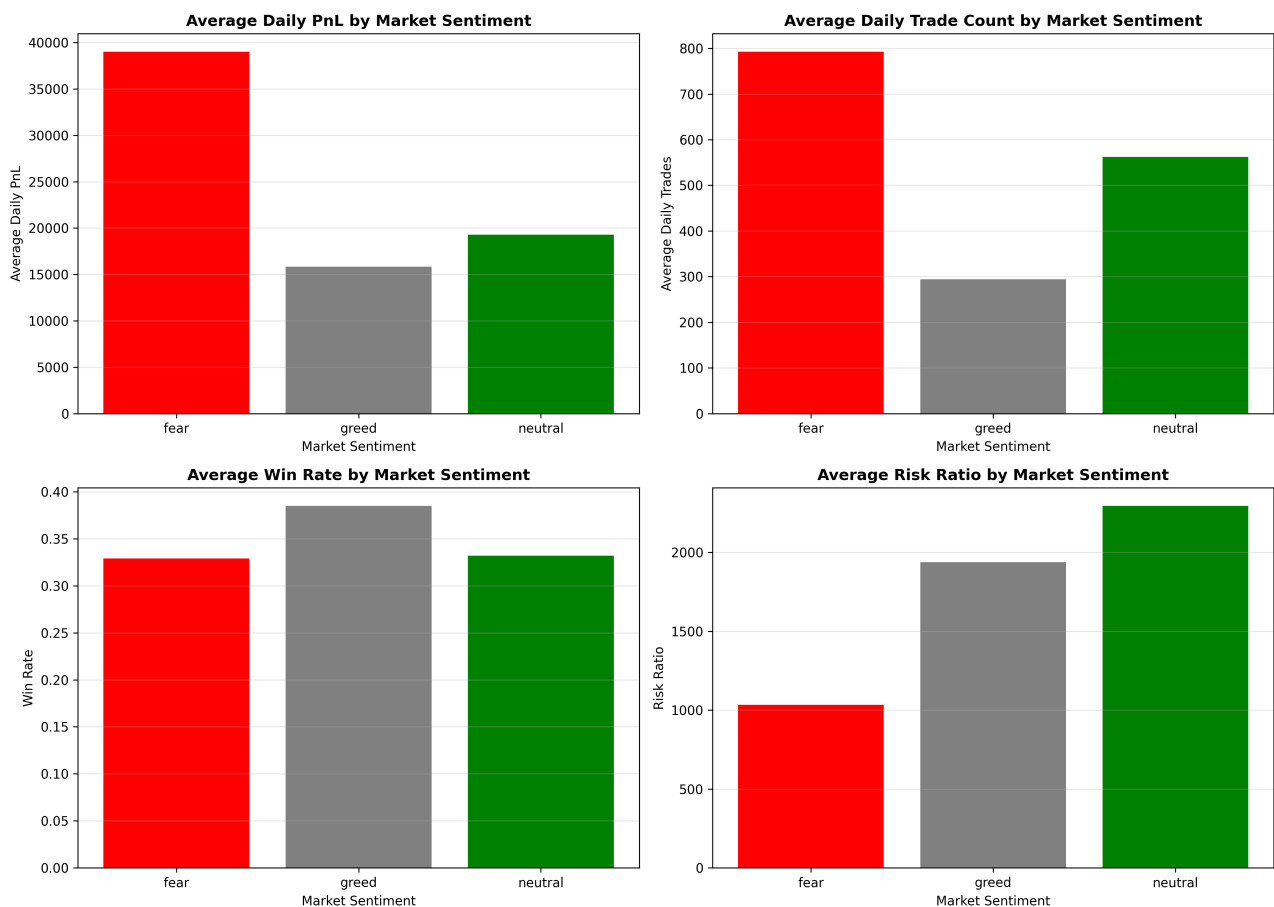# 3 Key Findings

3.1 Trading Activity by Sentiment

Figure 1: Comprehensive Sentiment Analysis: PnL, Trade Count, Win Rate, and Risk Ratio Comparison

Table 1: Daily Trading Metrics by Market Sentiment

Metric	Fear	Neutral	Greed
Avg Daily Trades	793	562	924
Avg Daily Volume (USD)	5.69M	2.69M	1.35M
Avg Daily PnL (USD)	39,012	19,297	15,848
Avg Win Rate	32.89%	33.19%	38.48%
Avg Risk Ratio	1,033	2,294	1,938

Observation 1 - Activity Paradox: Greed periods show +17% more trades than Fear periods (924 vs 793 daily), yet Fear periods generate significantly higher total volume (5.69M vs 1.35M USD). This suggests Greed attracts more retail participants with smaller position sizes.

Observation 2 - Profitability Divergence: Despite lower win rates, Fear periods yield $2.5\times$ higher daily PnL (39,012 vs 15,848 USD), indicating larger position sizes and better risk-adjusted returns during fearful conditions.

3.2 Risk-Taking Behavior

Risk Ratio Comparison: Greed periods exhibit 87% higher average risk ratios compared to Fear (1,938 vs 1,033), validating the hypothesis that traders take disproportionately large positions relative to their capital during euphoric market conditions.

Critical Insight: The highest risk quintile (risk ratio ¿ 12.37) shows the *lowest* win rate (31.6%), suggesting over-leveraged positions frequently result in liquidations or stop-outs.

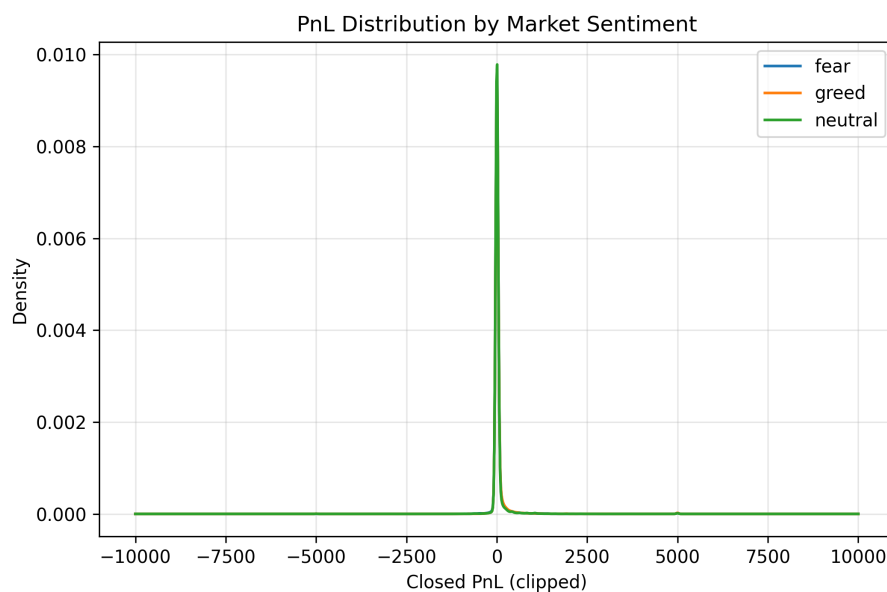## 3.3 Profitability Distribution Analysis

Figure 2: PnL Distribution by Market Sentiment (Kernel Density Estimation)

The PnL distribution reveals stark differences:

- **Fear:** Tightly clustered around zero with occasional large positive outliers (controlled risk-taking)
- **Greed:** Highly dispersed with fat tails on both sides (high volatility, erratic outcomes)
- **Neutral:** Narrow distribution with minimal tail risk (conservative behavior)

This pattern suggests Greed periods introduce higher outcome variance, making consistent profitability more difficult.

3.4   Winner Concentration (Top 10% Analysis)

Table 2: PnL Concentration Among Top 10% of Traders

Sentiment	Top 10% PnL Share
Fear	63.1%
Greed	57.9%
Neutral	70.3%

Insight: Greed periods exhibit the *lowest* profit concentration (57.9%), indicating democratized but inefficient profit distribution. Fear periods concentrate 63.1% of profits among sophisticated traders who capitalize on market dislocations.

3.5   Trading Efficiency: PnL Per Trade

Table 3: Average PnL Per Trade by Sentiment

Sentiment	PnL Per Trade (USD)
Fear	32.23
Greed	45.85
Neutral	63.82

Critical Finding: Despite higher daily PnL, Fear periods yield *lower* PnL per trade (32.23 vs 63.82 in Neutral). This indicates Fear traders deploy more trades but with smaller individual gains—a classic volume-over-precision strategy. Neutral conditions demonstrate the highest execution efficiency.

3.6   Sentiment Transition Dynamics

Analysis of 2,644 daily sentiment transitions reveals:

- **Fear Persistence:** 79% of Fear days are preceded by Fear/Extreme Fear (610 of 771 transitions)
- **Greed Stickiness:** 79% of Greed days follow Greed/Extreme Greed (498 of 632 transitions)
- **Regime Switches:** Extreme Fear → Fear (88 occurrences) is the most common transition out of fearful states

Strategic Implication: Sentiment regimes exhibit strong autocorrelation, allowing predictive modeling of behavioral continuity.

3.7   Risk-Performance Curve

Quintile analysis of risk ratios reveals:

- Moderate risk (0.0788 - 0.511) achieves highest win rates (43.2%)
- Extreme risk (¿12.37) yields lowest win rates (31.6%) despite highest average PnL per winning trade (71.50 USD)
- Conservative risk (¡0.00934) shows 45.6% win rate but limited upside (11.75 USD avg PnL)

Optimal Risk Zone: Traders in the 60-80th percentile of risk ratios (0.511 - 12.37) achieve balanced outcomes with 42.4% win rates and 62.32 USD average PnL.

4 Hidden Signals & Actionable Insights

4.1 Signal 1: Greed Overtrading Indicator

Pattern: Greed periods show 43% more trades than Neutral but only 24% higher win rates, suggesting overtrading behavior that erodes edge.

Action: Implement trade frequency throttling during extended Greed regimes to preserve capital and avoid compulsive execution.

4.2 Signal 2: Fear Entry Advantage

Pattern: Fear periods generate 2.5× daily PnL with 87% lower risk ratios, indicating institutional capital deployment during market dislocations.

Action: Increase position sizing during Fear transitions, targeting high-conviction setups with asymmetric risk-reward profiles.

4.3 Signal 3: Neutral Efficiency Dominance

Pattern: Neutral conditions yield highest PnL per trade (63.82 USD) with 70.3% profit concentration among top traders.

Action: During Neutral regimes, prioritize quality over quantity—focus on high-probability setups rather than activity-driven strategies.

4.4 Signal 4: Extreme Risk Warning

Pattern: Risk ratios above 12.37 correlate with 31.6% win rates, indicating overleveraged positions prone to adverse selection.

Action: Enforce dynamic position sizing limits that scale inversely with market volatility and sentiment extremes.

5 Limitations & Future Work

- **Data Scope:** Analysis limited to Hyperliquid platform; cross-exchange validation needed
- **Survivorship Bias:** Dataset may exclude liquidated accounts or inactive traders
- **Causality:** Correlation between sentiment and behavior does not imply causation
- **Leverage Data:** Actual leverage values not available; risk ratio serves as proxy

  Recommended Extensions:

- Intraday sentiment analysis using tick-level data
- Machine learning models predicting optimal position sizing by sentiment
- Cross-asset sentiment contagion analysis (BTC → altcoins)

6 Conclusion

This analysis demonstrates significant behavioral divergence across market sentiment regimes. Key takeaways:

1. **Fear = Opportunity:** Sophisticated traders achieve 2.5× higher daily PnL during Fear periods through larger, concentrated positions
2. **Greed = Inefficiency:** Increased activity during Greed (+17% trades) does not translate to proportional profitability
3. **Neutral = Precision:** Highest PnL per trade (63.82 USD) suggests optimal conditions for selective, high-conviction execution
4. **Risk Discipline:** Moderate risk-taking (0.511-12.37 ratio) optimizes win rates while avoiding overleveraged tail risk

These insights provide a foundation for developing sentiment-aware trading algorithms, dynamic risk management protocols, and behavioral finance models for cryptocurrency markets.