# Analyzing Trader Behavior and Market Sentiment in Bitcoin Trading

## Introduction

This study examines how trader behavior, profitability, volume, and risk align with Bitcoin market sentiment ranging from Fear to Greed. Using historical order data from Hyperliquid and the Fear & Greed sentiment index, we reveal behavioral patterns influencing smarter Web3 trading strategies.

## Data Overview

- Sentiment Dataset: Daily Fear & Greed index classifications and values from 2018 to 2025.
- Trader Dataset: Transaction level data from 32 traders and 246 trading symbols during 2024, including metrics like trade size, profit/loss, and timestamps.

## Methodology

- Date and time fields were standardized to datetime types across datasets.
- Missing data verification confirmed dataset integrity.
- Trader data is aggregated daily for key metrics: total trades, unique traders, average closed profit/loss, and total volume.
- Daily sentiment classifications merged with aggregated trader metrics.
- Visual explorations and statistical tests compared trader behavior during different sentiment regimes.
- Risk proxies, trade size variability (standard deviation), and maximum trade size were computed and analyzed by sentiment.
- Correlation coefficients quantified associations between continuous sentiment scores and trading activity.

# Key Findings

1. **Trading Activity Increases in Fear**
    - Both **total trades** (139 vs. 58) and **trading volume** (3.75M vs. 1.15M) are **significantly higher during Fear phases** compared to Greed ($p < 0.05$).
    - Boxplots confirm wider spreads and more extreme outliers in Fear, suggesting intense trading bursts during negative sentiment.

2. **Stable Trader Participation**
    - The number of unique traders remains nearly the same across Fear and Greed (1.59 vs. 1.46), with no significant statistical difference ($p = 0.245$).
    - This indicates that while overall market activity changes, the pool of active traders does not expand or contract substantially.

3. **Profitability Differences Are Not Significant**
    - Average closed PnL is higher in Fear (200 vs. 90), but this difference is **not statistically significant** ($p = 0.376$).
    - Profitability distributions show high variability and outliers, particularly in Neutral and Extreme Fear phases, reflecting inconsistent performance.

4. **Risk-Taking Behavior Amplifies Under Fear**
    - Measures of **trade size variability (STD)** and **maximum trade size** are elevated in Fear and Extreme Fear.
    - This suggests traders engage in larger and riskier trades during distressed sentiment conditions.

5. **Weak Correlations, Stronger Regime Effects**
    - Correlations between sentiment values and trading metrics (volume, trades, PnL) are weakly negative (-0.116 to -0.182).
    - Regime-based comparisons (Fear vs. Greed) provide **much clearer behavioral signals** than linear correlations.

# Conclusions

Contrary to the common belief that optimism fuels trading, this analysis reveals that **trading intensity is significantly higher during Fear phases**. Elevated trades, larger volumes, and riskier position sizes suggest that fear-driven markets trigger more activity, likely due to **panic selling, forced liquidations, and opportunistic entries**.

While profitability itself does not differ meaningfully between regimes, the behavioral patterns show that **market stress increases trading activity and volatility**.

### Recommendations

- **Intraday Monitoring:** Examine hourly sentiment shifts to capture short-term trading bursts during fear spikes.
- **Risk Controls:** Implement stricter leverage and position size controls during Fear phases, where volatility is highest.
- **Adaptive Strategies:** Explore automated strategies that dynamically adjust aggressiveness based on prevailing sentiment regimes.

# Appendix

### A. Data Files

- **Daily Aggregated Trader Data:** `daily_trader_metrics.csv`
- **Merged Trader Data with Sentiment Labels:** `merged_trader_sentiment.csv`

### B. Code and Reproducibility

- **Analysis Notebook:** `notebook_1.ipynb`
- **GitHub Repository:** GitHub Repo Link