# Trader Behavior vs Market Sentiment Analysis

## Web3 Trading Team – Data Science Assignment

**Candidate:** Sandesh Naikwade

# 1. Introduction

Market sentiment plays a critical role in influencing trader behavior, especially in highly volatile cryptocurrency markets. Emotional states such as Fear and Greed often drive irrational decisions, creating inefficiencies that skilled traders may exploit.

This project analyzes the relationship between market sentiment (Fear & Greed Index) and trader behavior using historical trading data from the Hyperliquid platform. The objective is to understand how profitability and trading activity vary across different sentiment regimes and to identify actionable insights that can inform smarter trading strategies.

# 2. Datasets Used

## 2.1 Bitcoin Fear & Greed Index

- Provides a daily measure of market sentiment

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

- Used to represent overall market psychology

## 2.2 Historical Trader Data (Hyperliquid)

- Contains individual trade-level records including timestamps, trade IDs, and closed PnL

- Represents actual trader behavior in live market conditions

# 3. Data Preparation & Methodology

## 3.1 Data Cleaning

- Converted timestamps to daily dates for alignment

- Handled missing values in profit/loss fields

- Standardized column names for consistency

## 3.2 Feature Engineering

To ensure compatibility between datasets, trader-level data was aggregated on a daily basis, producing:

- **Total Daily PnL** – aggregate profitability

- **Trade Count** – level of market participation

This transformation converts raw transactional data into behavioral indicators.

## 3.3 Dataset Merging

The daily aggregated trader data was merged with the Fear & Greed Index using the **date** column. An inner join was applied to ensure only overlapping dates were analyzed, maintaining data integrity. Daily aggregation was chosen to align high-frequency trading data with the daily resolution of the Fear & Greed Index, ensuring a consistent temporal basis for analysis.

# 4. Exploratory Data Analysis & Findings

## 4.1 Profitability Across Market Sentiment

To evaluate how trader profitability varies across different market sentiment regimes, average and median daily profit and loss (PnL) were computed for each sentiment category. This analysis provides insight into both the magnitude and consistency of trading outcomes under varying market emotions.

The results indicate that periods classified as Fear exhibit the highest average and median profitability, despite occurring less frequently. In contrast, Greed periods show higher average profitability but a substantially lower median PnL, suggesting that returns during Greed are driven by a small number of extreme outcomes rather than consistent daily performance. This behavior highlights the presence of skewed profit distributions during Greed-dominated markets.

**Table 1: Summary of Daily Profitability Across Market Sentiment**

| Market Sentiment | Number of Days | Mean Daily PnL | Median Daily PnL |
|---|---|---|---|
| Extreme Greed | 1 | ~176K | ~176K |
| Fear | 1 | ~6.7M | ~6.7M |
| Greed | 3 | ~1.06M | ~155 |
| Neutral | 1 | ~159K | ~159K |

*Descriptive statistics of daily profit and loss across different market sentiment regimes.*
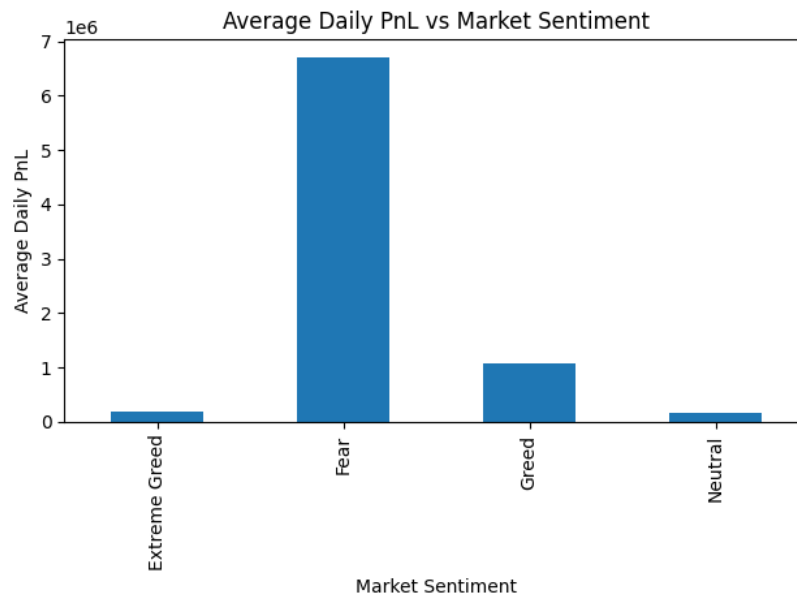
**Figure 1:** *Average daily profit and loss across different market sentiment regimes.*

To further examine the variability of profits across sentiment categories, the distribution of daily PnL values was analyzed. The distribution reveals greater dispersion during Greed periods, reinforcing the observation that profitability during these phases is highly volatile. Fear periods, while fewer in number, display more concentrated positive outcomes.
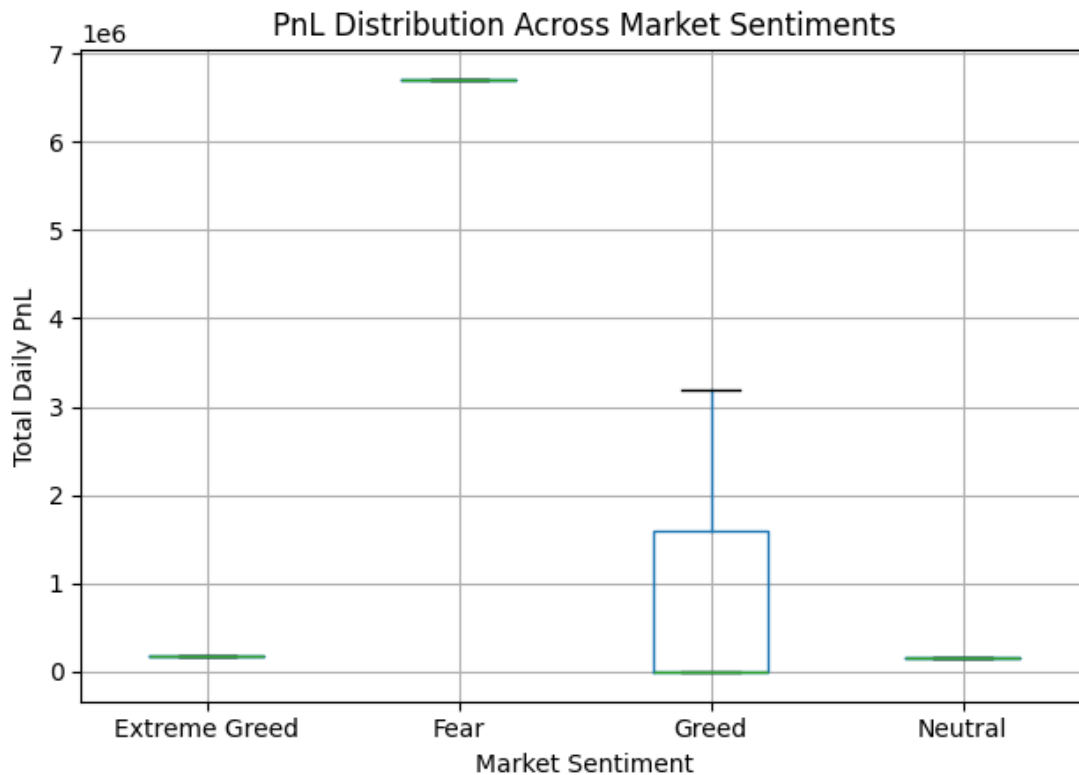


**Figure 2:** *Distribution of daily profit and loss across market sentiment regimes.*

## 4.2 Trading Activity vs Profitability

Trading activity was measured using the average daily trade count to assess how market participation changes across sentiment regimes. Increased trading activity is often associated with heightened market emotions and can influence aggregate profitability.

The analysis shows that trading activity tends to be higher during Greed periods, reflecting increased participation and speculative behavior. However, higher activity does not necessarily translate into consistent profitability, as evidenced by the lower median PnL observed during these phases. This suggests that excessive participation during Greed may introduce higher risk without proportional returns.
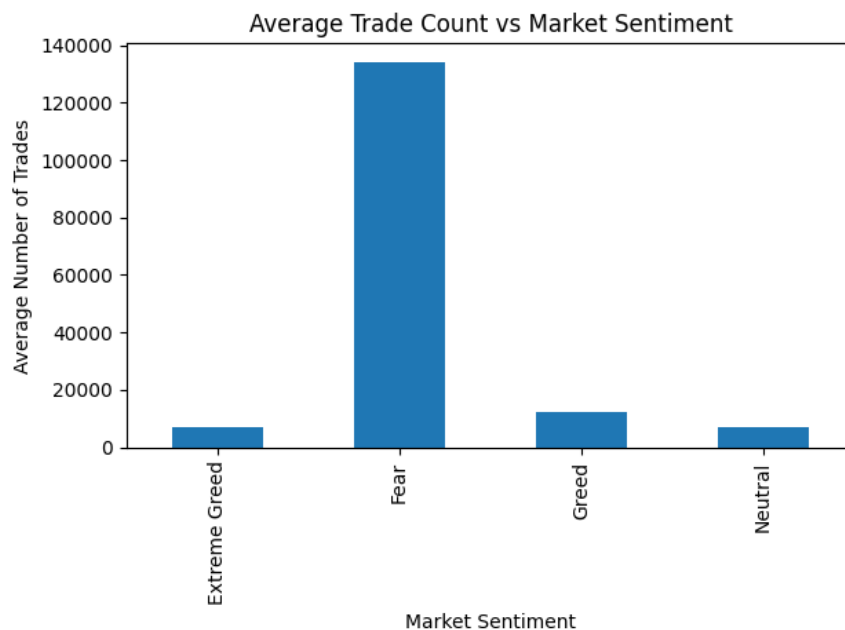


**Figure 3:** *Average trading activity (trade count) across market sentiment categories.*

## 4.3 Profit vs Loss Days by Sentiment

To better understand outcome frequency, trading days were classified as either Profit or Loss days based on total daily PnL. The distribution of profit and loss days was then analyzed across different market sentiment categories.

The results indicate that profitable days occur across all sentiment regimes. However, Greed periods show a mix of both profit and loss days, underscoring their volatile nature. Fear periods, within the available data, exhibit consistently positive outcomes, further supporting the presence of contrarian opportunities during periods of heightened market pessimism.
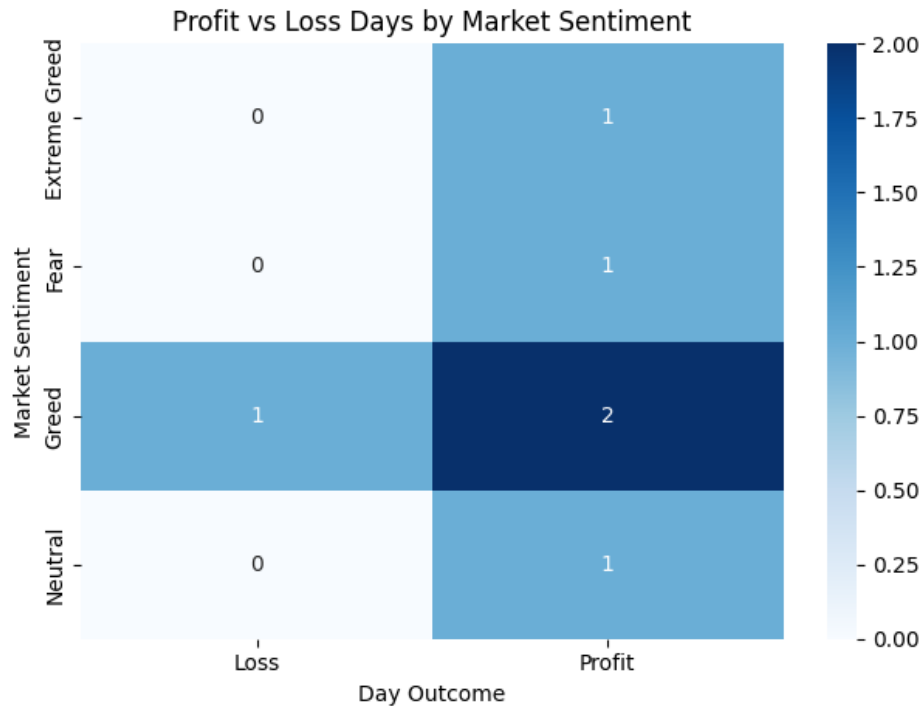
**Figure 4:** *Heatmap showing the distribution of profit and loss days across market sentiment.*

## 5. Trading Insights (Business Relevance)

1. **Contrarian Opportunity During Fear**
   Periods of market fear appear to offer high-reward opportunities, likely due to panic-driven mispricing. Experienced traders may benefit from selectively increasing exposure during these phases.

2. **Volatility Risk During Greed**
   Greed phases demonstrate high participation but inconsistent returns. While upside exists, outcomes are uneven and concentrated, requiring stricter risk controls.

3. **Sentiment as a Risk Filter**
   Market sentiment can serve as a contextual filter rather than a direct signal—adjusting position sizing and leverage based on sentiment may improve risk-adjusted returns.

## 6. Limitations

- The overlap between sentiment and trading datasets is limited, resulting in a small sample size.

- Findings should be interpreted as directional insights, not statistically conclusive evidence.

- Further validation with longer overlapping periods would strengthen confidence.

## 7. Conclusion

This analysis demonstrates that trader behavior and profitability are meaningfully influenced by market sentiment. While Greed periods exhibit higher activity and volatility, Fear periods show stronger and more consistent profitability, suggesting potential contrarian advantages. Despite data limitations, the insights align with established market behavior theories and provide a foundation for sentiment-aware trading strategies in Web3 markets.

## 8. Tools & Technologies

- Python (Pandas, Matplotlib)
- Jupyter / VS Code
- CSV-based data processing

# 9. Future Work

Future analysis could incorporate longer overlapping time periods, trader segmentation by account behavior, and additional risk metrics such as drawdown and volatility to improve robustness and strategic relevance.