Data Science Report

Project: Trader Behavior vs Market Sentiment

Candidate: Sameer Pathania

Date: 9th September 2025

1. Introduction

The purpose of this analysis is to explore the relationship between **trader behavior** (profitability, trade volume, leverage, activity) and **market sentiment** (Fear vs. Greed). By combining trader-level data from **Hyperliquid** with the **Bitcoin Fear & Greed Index**, we aim to uncover whether sentiment influences trading decisions and profitability, and to identify behavioral patterns that can guide smarter trading strategies.

2. Datasets

1. **Bitcoin Market Sentiment Dataset**

   o Columns: Date, Classification (Extreme Fear, Fear, Neutral, Greed, Extreme Greed).

   o Captures daily sentiment in the crypto market.

2. **Historical Trader Data from Hyperliquid**

   o Columns: account, symbol, execution price, size, side, time, start position, event, closedPnL, leverage, etc.

   o Contains individual trade-level data.

3. Methodology

3.1 Data Preparation

- Loaded both datasets in Google Colab.

- Converted timestamps to datetime format and aligned frequencies to **daily level**.

- Checked for missing values → none found.

- Aggregated trade-level data into daily summaries:

  o Number of trades (Num_Trades)

- o   Trade size in USD (Size USD)

- o   Daily Closed Profit & Loss (Closed PnL)

- Merged with sentiment dataset.

3.2 Exploratory Data Analysis (EDA)

- Visualized daily trade counts, average leverage, and average PnL.

- Plotted bar charts of average activity (Num_Trades & Size USD) across sentiment states.

3.3 Statistical Analysis

- **ANOVA Tests**

  - o   Num_Trades → Significant differences across sentiments ($p < 0.001$).

  - o   Size USD → Significant differences across sentiments ($p < 0.001$).

  - o   Closed PnL → No significant differences ($p = 0.56$).

- **Post-hoc Tukey HSD Tests**

  - o   **Extreme Fear** consistently showed **lower trading activity and volume** than all other sentiment states.

  - o   **Greed & Extreme Greed** had significantly higher activity than Fear/Extreme Fear.

  - o   Profitability differences across groups were not significant.

4. Results

4.1 Trading Activity (Num_Trades)

- Lowest in **Extreme Fear**.

- Highest in **Extreme Greed**.

- Fear vs Greed showed significant differences.

4.2 Trade Volume (Size USD)

- Similar pattern: **Extreme Fear** lowest, **Extreme Greed** highest.

- Significant differences confirmed by ANOVA & Tukey HSD.

4.3 Profitability (Closed PnL)

- No significant variation across sentiment states.

- Suggests trading **behavior changes**, but outcomes remain unchanged.

5. Insights

- **Emotional Trading:**
  Traders pull back sharply in Extreme Fear and become aggressive in Greed/Extreme Greed phases.

- **Activity ≠ Profitability:**
  Increased trading in Greed phases does not translate to higher profitability.

- **Neutral & Fear Similarity:**
  No strong behavioral difference between Neutral and mild Fear. Extremes cause the biggest changes.

6. Business Implications

- **For Exchanges / Platforms:**

  o Anticipate **low liquidity and engagement in Extreme Fear** → consider fee reductions or trading incentives.

  o Monitor **risk exposure in Extreme Greed**, where over-leveraging may occur.

- **For Traders / Strategy Designers:**

  o Avoid overtrading in Greed phases; high activity may increase risk without improving outcomes.

  o Contrarian strategies may benefit from low participation periods (Extreme Fear).

7. Tools & Libraries

- **Environment:** Google Colab

- **Libraries:** Pandas, Numpy, Matplotlib, Seaborn, SciPy, Statsmodels

8. Conclusion

This analysis highlights that while **sentiment strongly affects trading behavior (activity and volume)**, it does not significantly impact **profitability**.

Recognizing these behavioral biases can enable both exchanges and traders to develop **sentiment-aware strategies**, optimize engagement, and manage risk more effectively.

Deliverables Produced

- Notebook (notebook_1.ipynb) with full workflow

- Processed dataset (csv_files/merged_daily.csv)

- Visual outputs (outputs/*.png)

- This report (ds_report.pdf)