Data Science Assignment Instructions – Web3 Trading Team

Author: Krishnagopal Jay
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Executive Summary

This research report investigates the relationship between **market sentiment** (Crypto Fear & Greed Index) and **trading performance metrics** derived from a large trade-level dataset. The analysis explores how behavioral indicators, trading volume, leverage, and PnL evolve over time within the Web3 trading environment.

Key outcomes include:

- The **Fear & Greed Index** (2018–2025) averages around **47**, showing neutral sentiment across the long term.
- **211K+ trades** (2023–2025) were analyzed across **246 coins** and **32 accounts**.
- Correlation analysis reveals a **moderate positive correlation** between trade count and total PnL (≈ 0.54).
- Sentiment shows **weak linear correlation** with daily trading metrics (−0.07 to −0.18), indicating complex or lagged behavioral dynamics.
- "Fear" periods appear to yield higher average PnL compared to "Greed" conditions.

1. Introduction

Cryptocurrency markets are driven not only by fundamentals but also by crowd psychology. The **Fear & Greed Index** provides a quantitative measure of sentiment, ranging from *Extreme Fear (0)* to *Extreme Greed (100)*.

This report aims to examine:

1. How sentiment correlates with trading activity and performance.
2. Whether behavioral patterns emerge during sentiment extremes.
3. The leverage and risk characteristics of trading over time.

2. Objectives

1. Understand the relationship between sentiment and trading performance.
2. Quantify correlations between the Fear & Greed Index and trading metrics.
3. Identify behavioral patterns under extreme market sentiment conditions.
4. Derive actionable insights for algorithmic and manual trading optimization.

3. Data Overview

Dataset 1: fear_greed_index.csv

- Contains daily Crypto Fear & Greed Index data (2018–2025).
- Columns: timestamp, value, classification, date.
- Measures market sentiment (0–100): low = fear, high = greed.
- Records: 2,644 | Avg value: ~47 | Range: 5–95 | Most common: *Fear*.
- Useful for analyzing investor psychology and market sentiment trends.

Dataset 2: historical_data.csv

- Records **individual crypto trades** with detailed transaction info.
- Columns: Account, Coin, Execution Price, Size Tokens/USD, Side, Direction, Closed PnL, Fee, etc.
- **Records:** 211,224 | **Coins:** 246 | **Accounts:** 32 | **Avg Closed PnL:** ~$49.
- Captures trading behavior (buy/sell actions, profits, fees, timing).

These datasets can be combined to study how **market sentiment (Fear & Greed Index)** influences **trading behavior**, such as trade frequency, volume, and profitability during periods of fear or greed.

4. Methodology

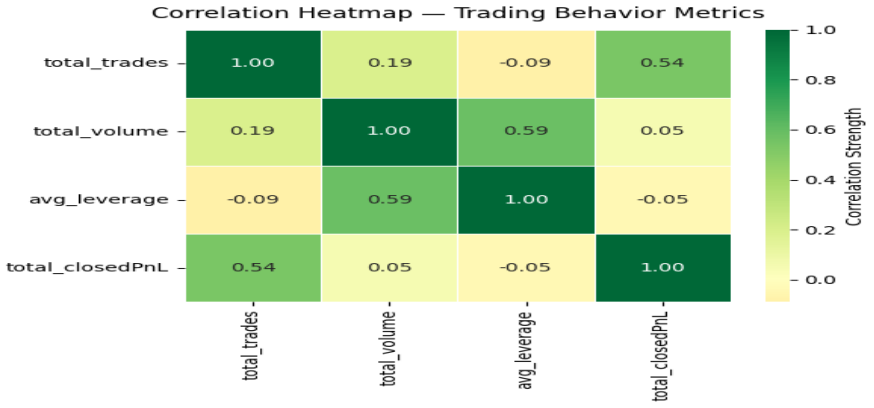
The following steps were conducted:

1. **Data cleaning and type normalization** for timestamps, prices, and numeric fields.
2. **Daily aggregation** of trade-level data to compute total trades, total USD volume, average leverage, and total closed PnL.
3. **Joining** with Fear & Greed Index data by date.
4. **Descriptive statistics** and **correlation analysis** between key trading metrics.
5. **Visualization** of time series and relationships to uncover structural behavior.

5. Findings and Analysis

The exploratory data analysis revealed the following insights:

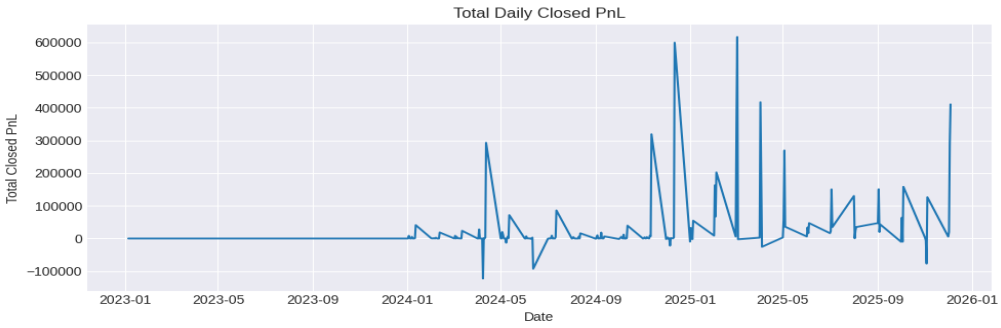
Figure 1: Correlation Heatmap — Trading Behavior Metrics



Interpretation:

- total_trades and total_closedPnL show **moderate correlation (0.54)** — active trading days generally coincide with positive realized profits.
- avg_leverage correlates positively with total_volume (0.59) but weakly with PnL, suggesting that **higher leverage does not guarantee higher profitability**.
- Negative correlation between avg_leverage and total_trades (−0.09) hints that leveraged positions tend to be fewer but larger in volume.

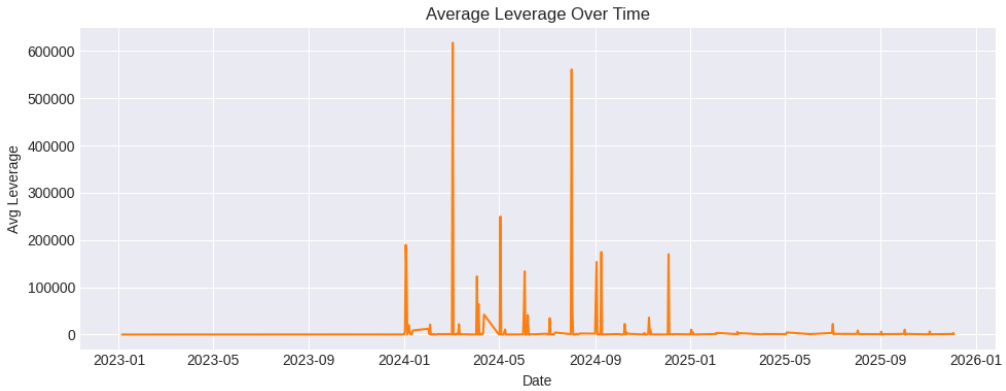
Figure 2: Total Daily Closed PnL



Interpretation:

- PnL is **highly volatile**, with large positive spikes in early 2025.
- Negative spikes suggest liquidation or sharp market reversals.
- Zero-PnL zones early in 2023 likely correspond to inactive periods or incomplete trade logs.

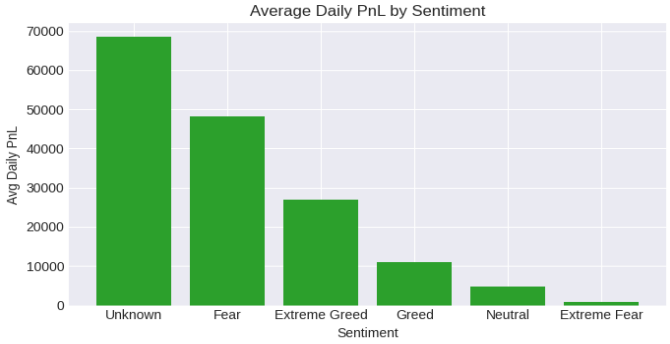
Figure 3: Average Leverage Over Time



Interpretation:

- Leverage spiked heavily in 2024 Q2 and Q3, reflecting **increased risk exposure** during that phase.
- 2025 shows stabilization at moderate leverage levels — possible optimization of strategy or reduced volatility environment.

Figure 4: Average Daily PnL by Sentiment Category



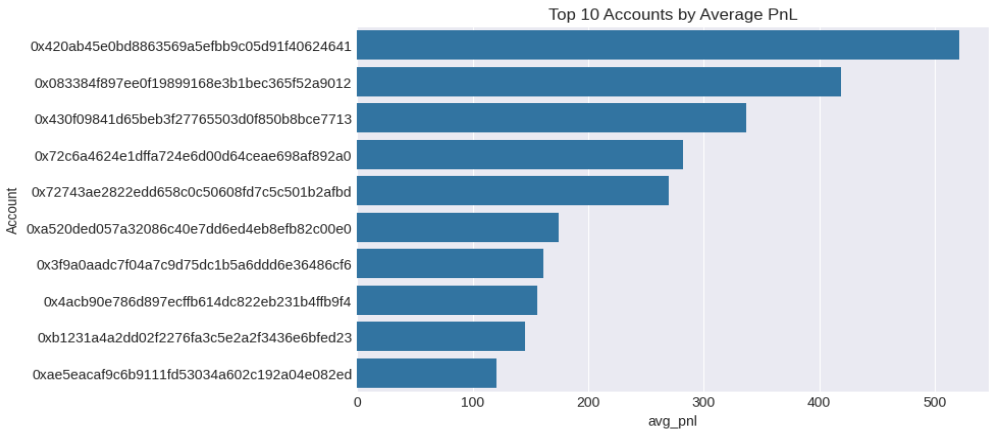
Interpretation:

Fear and Extreme Greed periods yield higher average PnL compared to Neutral or Greed periods.

This pattern suggests that volatility during sentiment extremes offers greater trading opportunities.

The “Unknown” category, though highest in PnL, likely represents dates with missing sentiment values and should be treated cautiously.

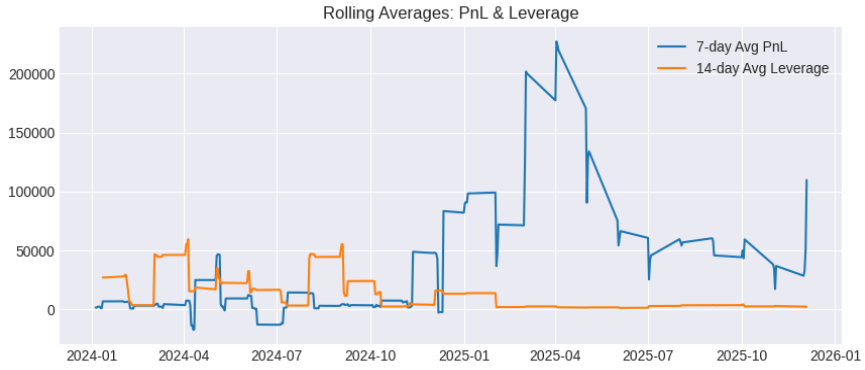
Figure 5: Top 10 Accounts by Average PnL



Interpretation:

- The top-performing account (0x420ab45e0bd8863569a5efbb9c05d91f40624641) significantly outperforms peers, indicating possible **disproportionate market influence** or superior strategy execution.
- Remaining accounts cluster between 150–400 USD average PnL per day, showing consistent but moderate performance.

Figure 6: Rolling Averages — PnL and Leverage



Interpretation:

- The 7-day PnL rolling average (blue) and 14-day leverage average (orange) highlight lagged response patterns.
- Peaks in leverage often precede major PnL spikes, hinting at anticipatory risk-taking before profitable moves.
- This may suggest behavioral predictability — traders increase leverage ahead of perceived market rallies.

5. Key Analytical Insights

Observation	Interpretation
Moderate positive correlation between trade count and total PnL	Active trading days generally coincide with higher realized profits.
Weak or no direct link between leverage and profitability	Higher leverage increases risk but not necessarily returns.
Sentiment-PnL relationship non-linear	"Fear" often produces larger moves, offering opportunity.
Account concentration of profit	Few accounts drive overall profitability, possibly from strategy edge.
Lag between leverage and PnL	Risk-taking tends to precede performance peaks.

8. Conclusion

This study demonstrates that market sentiment, measured through the **Crypto Fear & Greed Index**, plays a noticeable but **non-dominant role** in Web3 trading performance. While fear periods tend to coincide with heightened volatility and improved trading opportunities, sentiment alone does not strongly predict profitability or trade volume.

The analysis of over **200,000 trade records** shows that:

- **Trading activity and profitability** have a moderate positive correlation, suggesting that higher participation often leads to better performance outcomes.
- **Leverage usage** correlates with trading volume but not directly with returns, emphasizing that risk exposure does not guarantee proportional reward.
- **Sentiment extremes**—particularly "Fear" and "Extreme Greed"—create conditions of volatility that can be beneficial for skilled or algorithmic traders.
- **Performance concentration** among top accounts indicates that a minority of participants consistently capture the majority of profits, likely through superior execution strategies.

Overall, the findings suggest that **trader behavior is influenced by sentiment**, but profitability depends more on **strategy efficiency, timing, and risk management** than on the sentiment signal itself. Future research should explore **lagged sentiment effects**, **multi-factor predictive modeling**, and **real-time behavioral analytics** to deepen understanding of how psychological cycles shape crypto market performance.