Analysis of Trader Behavior vs Market Sentiment

Author: *Abhishek Pratap Singh*
Role: *Data Science Intern*
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1. Introduction

This report presents an analysis of how trader behavior aligns with overall Bitcoin market sentiment using real trading data. The study combines on-chain trading metrics with the Fear & Greed Index to understand when traders perform better — during fear-driven markets or greed-dominated rallies.

The goal of this assignment was to extract meaningful behavioral insights and support them with clean data processing, statistical summaries, and visual validation.

2. Data Overview

Two datasets were analyzed:

Dataset	***Description***
Market Sentiment (Fear & Greed Index)	*Provides a daily sentiment score (0–100) and classification such as Extreme Fear, Fear, Neutral, Greed, or Extreme Greed.*
Trader Data (Hyperliquid Exchange)	*Contains detailed trade-level records including price, size, side (buy/sell), closed PnL, timestamps, and unique trader accounts.*

Records analyzed: *211,224 trades*
Time period: *2023–2024*

3. *Data Processing and Feature Engineering*

1. ***Timestamp Correction***
    - *Original timestamps were in milliseconds UNIX format.*
    - *Converted to human-readable datetime objects and extracted daily* `date`*.*
2. **Aggregation**
    - Grouped data by `date` to compute daily trading summaries:
        - `Total_PnL` – sum of closed profit and loss
        - `Total_Volume_USD` – total traded USD volume
        - `Avg_Execution_Price` – mean trade price
        - `Unique_Traders` – number of distinct accounts active that day
3. ***Merging Datasets***
    - *Joined aggregated trader data with the sentiment dataset using the* `date` *field.*
    - *Each trading day was now labeled with its corresponding sentiment classification and sentiment score (*`value`*).*

4. Exploratory Data Analysis

After cleaning and merging, exploratory analysis was performed to uncover relationships between sentiment and trading behavior.

Key Questions Explored

1. *How does trader profitability vary across different market sentiments?*
2. *Does trading volume increase when the market is fearful or greedy?*
3. *Is there a measurable correlation between sentiment value and profit?*

5. Results & Insights

5.1 Profitability vs Market Sentiment (Fig : 1)

- *Average daily profit (Total_PnL) was **highest during "Fear" periods** (~114k USD).*
- *Profits dropped sharply in **"Greed"** and **"Extreme Greed"** phases.*
- *Visual evidence: boxplot showed median profit levels significantly higher in "Fear."*

Interpretation:
Traders tend to perform better during fearful markets, likely following a contrarian strategy — buying when others are cautious.

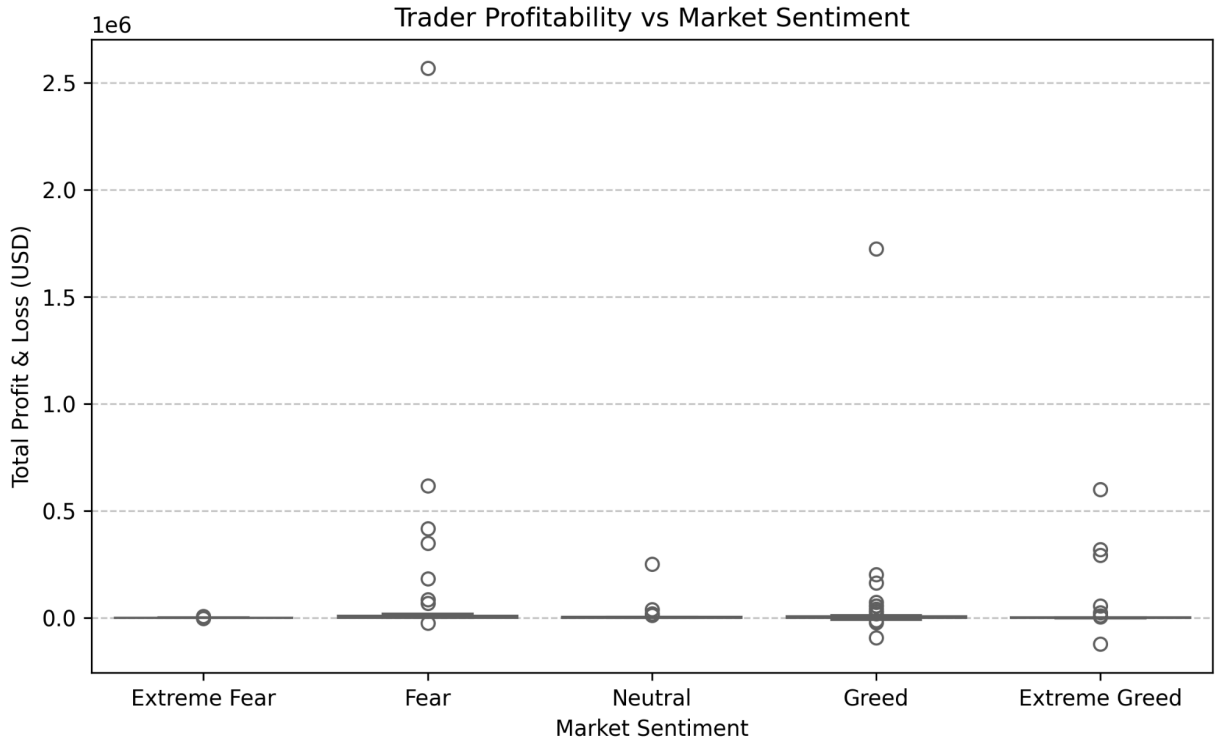

Figure 1: Profit distribution across market sentiment categories.

5.2 Trading Volume vs Market Sentiment (Fig : 2)

- *Trading activity peaked during "Fear," followed by "Greed" and "Extreme Fear."*
- *Average daily volume during "Fear" was around **1.04×10^7 USD**, almost double compared to greedier periods.*

Interpretation:
Experienced traders become more active in fear-driven conditions, taking advantage of volatility and panic selling.

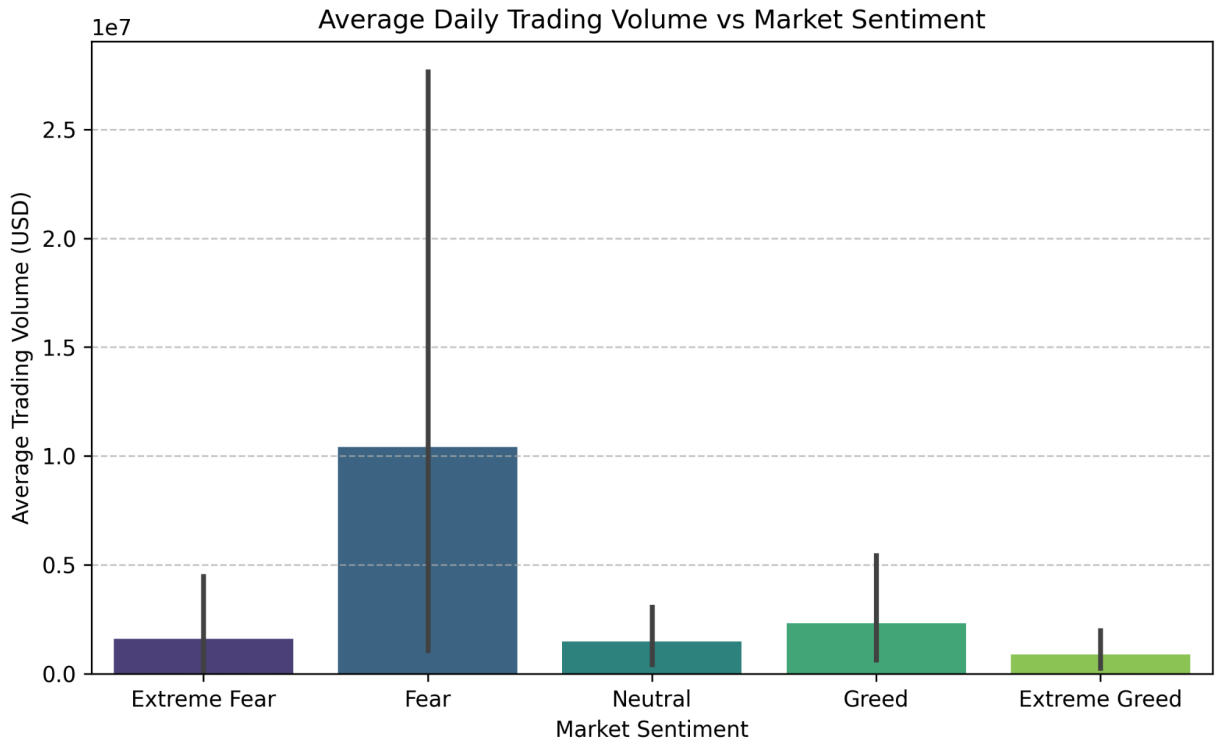

Figure 2: Average daily trading volume vs sentiment.

5.3 Sentiment Value vs Profit (Continuous Relationship)(Fig : 3)

- *Scatter and regression plots show **most data points clustered between sentiment values 50–80** (neutral to greedy).*
- *Most daily profits hovered around 0 USD, with a few higher-profit outliers.*
- *The regression line had a **slight downward slope**, confirming a weak **negative correlation (≈ -0.038)** between sentiment and profit.*

Interpretation:
As the market becomes greedier, trader profitability slightly declines — possibly due to over-leveraging or momentum chasing in optimistic conditions.

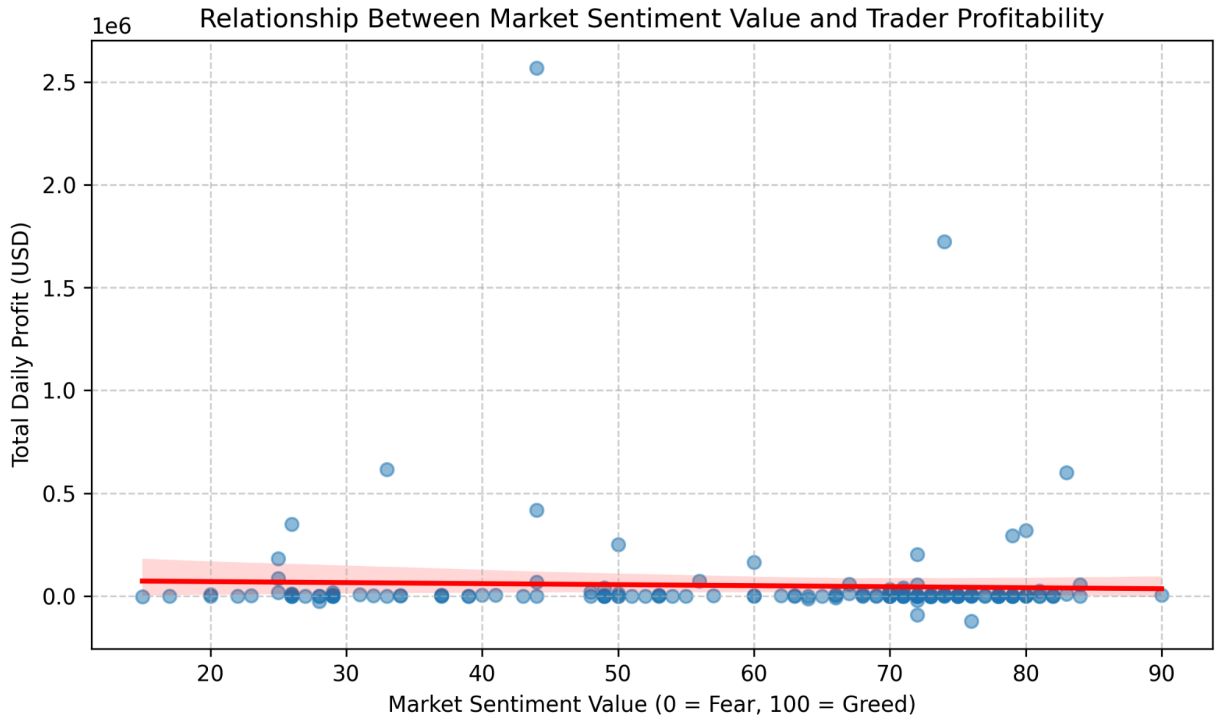

Figure 3: Relationship between sentiment value (0–100) and total daily profit.

6. Strategic Takeaways

- ***Contrarian Trading Works:*** *Fear periods are historically more profitable — indicating potential for contrarian or dip-buying strategies.*
- ***Risk Management During Greed:*** *Traders should apply tighter controls during greed phases where returns flatten and volatility rises.*
- ***Sentiment-Aware Systems:*** *Integrating the Fear & Greed Index into trading algorithms could enhance entry timing and portfolio rebalancing logic.*

7. Conclusion

This analysis confirms that ***market sentiment strongly influences trading behavior and profitability****.*
Periods of ***fear*** *attract more active and successful trading, while* ***greedy markets*** *often lead to smaller or negative returns.*
By embedding sentiment metrics into future trading models, we can better align risk appetite with market psychology.