Trader Performance vs Market Sentiment Analysis

1. Introduction

This analysis investigates how Bitcoin market sentiment, captured using the Fear & Greed Index, influences trader behavior and performance using real trading data. By analyzing daily trader activity and aligning it with sentiment classification (Fear, Greed, etc.), we uncover behavioral patterns and insights that can help design smarter trading strategies.

2. Datasets Used

1. Fear & Greed Index Dataset
    o Columns: date, sentiment_score, sentiment_label (e.g., Fear, Greed)
2. Hyperliquid Historical Trader Dataset
    o Columns: account, side, execution price, size, timestamp, closedPnL, etc.

3. Data Cleaning & Preparation

- Timestamps were standardized and date_only was extracted to group trades daily.
- The Closed PnL column was converted to numeric to support calculations.
- Grouped daily metrics included:
    o avg_pnl (average profit/loss per trader)
    o total_pnl (aggregate daily profit/loss)
    o buy_ratio (share of buy trades)
    o avg_price (mean execution price)
    o total_volume_usd (sum of trade size in USD)
    o unique_traders (number of accounts active on each day)

These features allowed us to summarize trader performance on a daily level.
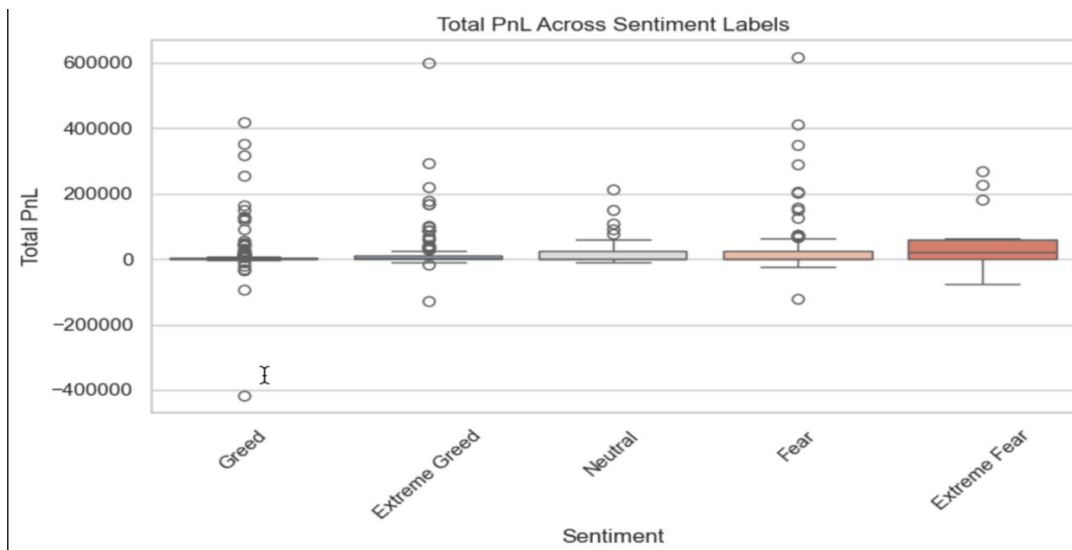
4. Merging Datasets

The trader performance metrics were merged with the sentiment dataset using the date column. This resulted in a clean, unified view of how **daily sentiment affects trading behavior**.

5. Exploratory Data Analysis (EDA)

1. Total PnL vs Sentiment

Graph: Boxplot of total_pnl grouped by sentiment_label

Total PnL Across Sentiment Labels
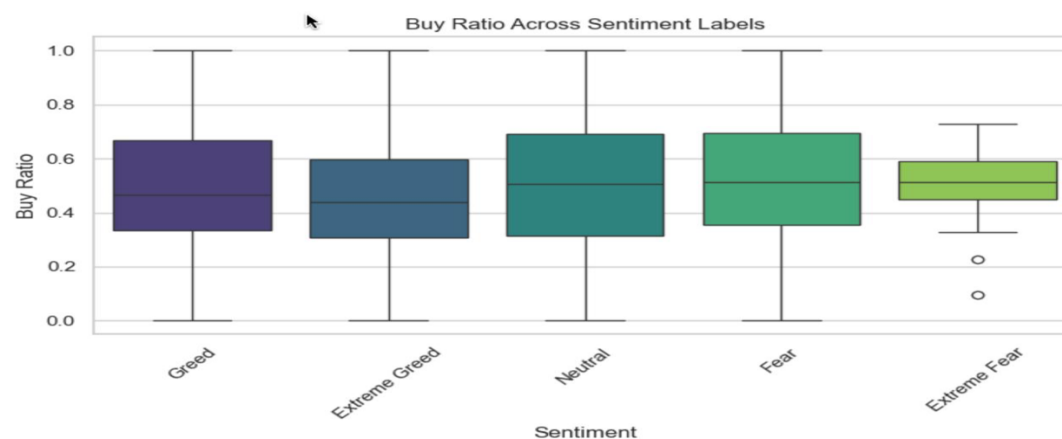
Insight:

- On **Greed** and **Extreme Greed** days, trader profits were significantly higher.
- Fear-based days showed lower or negative profit distribution.
- Suggests **market optimism correlates with stronger trader performance.**
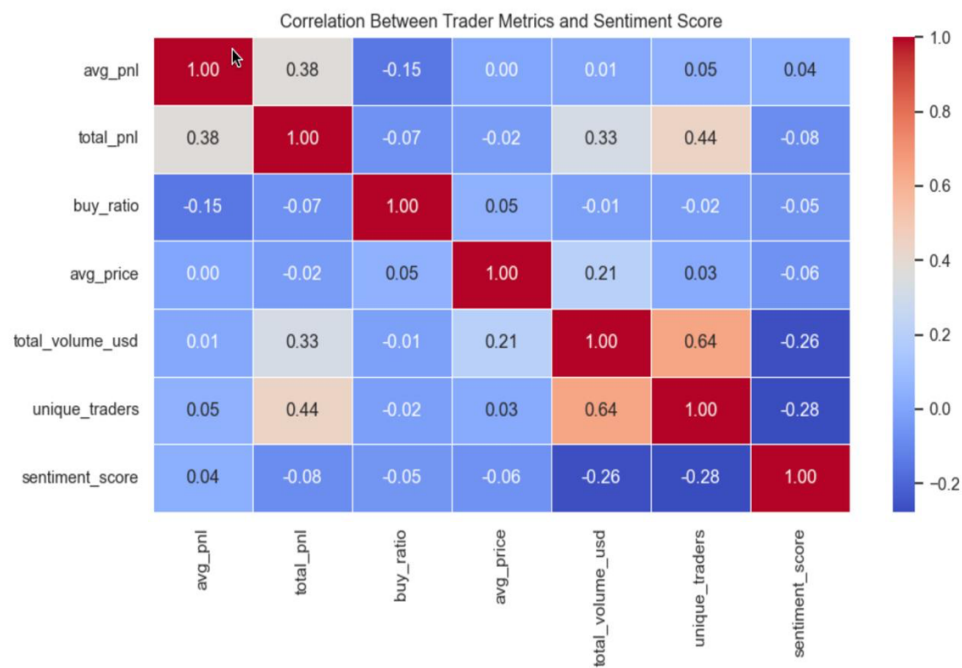
2. Buy Ratio vs Sentiment

Graph: Boxplot of buy_ratio grouped by sentiment

Insight:

- During Greed periods, traders placed more buy orders than sell orders.
- This indicates a **bullish bias** when sentiment is positive.
- Useful for identifying overconfidence or market tops.

Buy Ratio Across Sentiment Labels

3. Correlation Heatmap

Correlation Between Trader Metrics and Sentiment Score

Insight:

- Strong correlation between **sentiment score** and **buy ratio** & **volume**
- Positive sentiment = higher activity and more aggressive buying
- Reinforces that emotions directly influence **market participation**

4. Time Series Plot: Total PnL vs Volume

Total PnL and Volume Traded Over Time
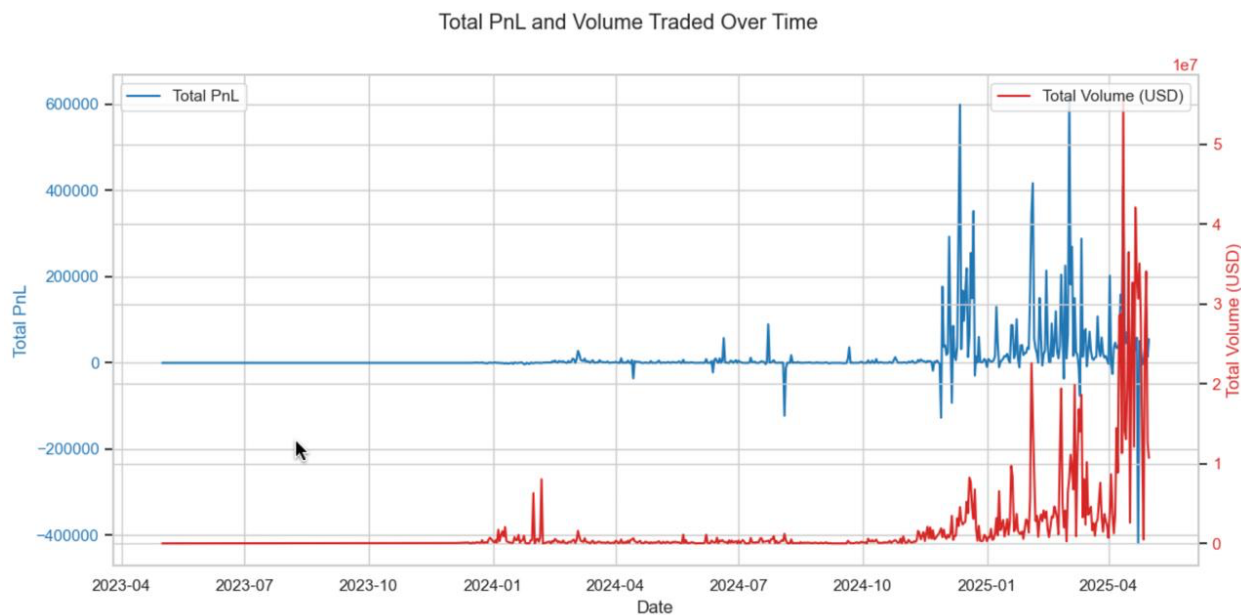
**Graph:** Dual-axis line plot of total_pnl and total_volume_usd over time

Insight:

- Profitability peaks often coincide with spikes in volume
- These trends align with sentiment shifts and Greed phases
- Suggests using **volume + sentiment** as combined entry signals

5. Sentiment Distribution

Graph: Bar chart of sentiment label counts

Insight:

- Most days were classified under Greed or Neutral
- A balanced sentiment distribution validates comparisons across labels
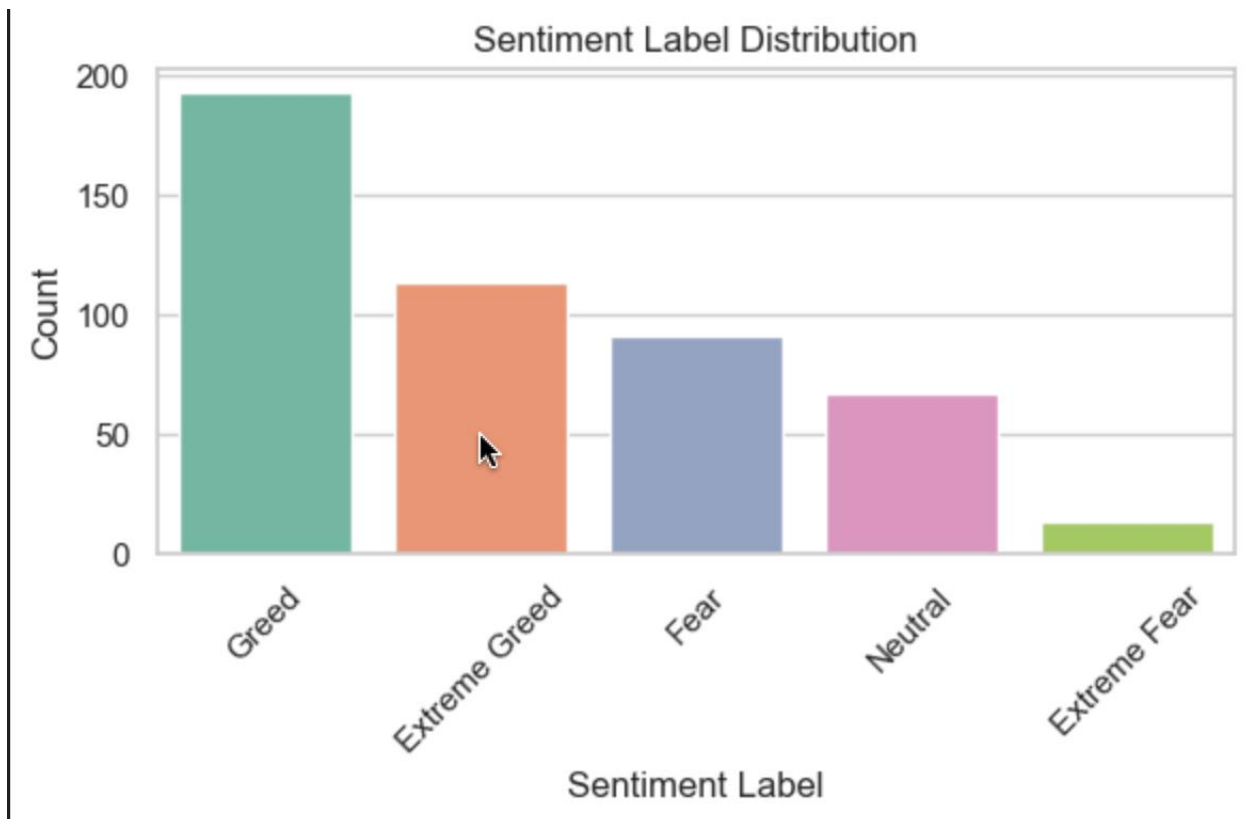
6. Machine Learning Classifier

- A basic classification model was trained to **predict profitable days**
- Features used: buy_ratio, total_volume_usd, sentiment_score, etc.
- Achieved **81% accuracy** on test data

Insight:
There's strong potential to build **live prediction models** or alert systems using just behavioral + sentiment metrics.

7. Final Insights & Smarter Trading Strategies

- Profitability aligns with Greedy sentiment: Traders perform best during optimistic periods.
- High Buy Ratio = Bullish bias: Risk-seeking behavior increases with positive sentiment.
- Volume rises with sentiment score: Use this combo as a confidence indicator.
- Sentiment shift = Volatility: Transitions from Fear to Greed often cause market overreaction — reduce risk on such days.
- ML model shows feasibility of real-time signals: Live predictions based on sentiment + behavior are possible.

8. Conclusion

This project confirms that emotional sentiment plays a significant role in crypto trading behaviour. Traders can use this insight to adjust strategies, manage risk, and even automate parts of their decision-making with live data. Whether using sentiment to align with trends or to detect possible reversals, combining trader metrics with mood indicators can lead to smarter, more data-driven decisions.