

DATA SCIENCE ASSIGNMENT REPORT

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Project: Analysis of Trader Behavior vs Market Sentiment (Web3 Trading Team)

1. Introduction

This report analyzes the relationship between trader behavior and Bitcoin market sentiment using two datasets:

- **Bitcoin Market Sentiment Dataset** (Fear & Greed Index)
- **Historical Trader Data from Hyperliquid**

The objective is to explore how trading metrics such as profitability, volume, and leverage align or diverge with market sentiment (Fear vs Greed), and to identify hidden trends that can inform smarter trading strategies.

2. Data Description

- **Fear & Greed Index Dataset:** Contains daily sentiment values and classifications (Fear, Greed, etc.) with columns: **date**, **value**, **classification**.
- **Historical Trader Data:** Contains detailed trade-level data including **account**, **symbol**, **execution price**, **size**, **side**, **time**, **closedPnL**, **leverage**, etc.

3. Methodology

- **Data Loading & Cleaning:**
Both datasets were loaded and cleaned. Date columns were converted to datetime format. Numeric columns were typecast appropriately. Missing values were handled or noted.
- **Feature Engineering:**
Extracted daily summaries such as total trading volume, total closed PnL, and average leverage.
- **Data Merging:**
Merged trader data with sentiment data on the **date** column to analyze relationships.
- **Exploratory Data Analysis (EDA):**
Visualized sentiment trends, trading volume, PnL distributions, and trade side distributions.

- **Advanced Analysis:**

Analyzed average profitability and volume by sentiment classification. Conducted time-lagged analysis to check if previous day sentiment affects trading outcomes. Performed ANOVA tests to check statistical significance.

4. Key Findings

- **Sentiment Trends:**

The Fear & Greed Index fluctuates over time, with distinct periods of fear and greed.

- **Profitability vs Sentiment:**

Average closed PnL varies across sentiment classifications. For example, profitability tends to be higher during greed phases compared to fear phases (see Figure: avg_pnl_by_sentiment.png).

- **Volume vs Sentiment:**

Trading volume also shows variation with sentiment, with higher volumes observed during greed periods.

- **Leverage Usage:**

Leverage distribution varies with sentiment, indicating traders may take on more risk during certain market moods.

- **Time-lagged Effects:**

Previous day's sentiment has a measurable impact on next day's trading profitability, suggesting sentiment can be a leading indicator.

- **Statistical Significance:**

ANOVA tests confirm that differences in profitability across sentiment classes are statistically significant (p-value < 0.05).

5. Hidden Trends and Signals

- Traders tend to increase leverage and volume during greed phases, which may amplify profits but also risks.
- Sentiment shifts from fear to greed often precede spikes in trading activity and profitability.
- Time-lagged sentiment analysis suggests potential for predictive trading strategies based on sentiment momentum.

6. Limitations

- Data granularity is daily; intraday sentiment or trade timing effects are not captured.
- Some missing or inconsistent data points may affect accuracy.
- Leverage data was not always available for all trades.

7. Conclusion and Recommendations

- Market sentiment is a valuable indicator of trader behavior and profitability.
- Incorporating sentiment analysis into trading strategies can improve timing and risk management.
- Traders should be cautious of increased leverage during greed phases to avoid amplified losses.
- Further research with higher frequency data and additional features is recommended.

8. References

- Fear & Greed Index Dataset
- Hyperliquid Historical Trader Data