

DATA SCIENCE ASSIGNMENT REPORT

Web3 Trading Team — Data Science Assignment

Candidate Name: Avinashkumar Rajbhar

Submission Folder: ds_avinash

1. INTRODUCTION

The purpose of this analysis is to explore the relationship between on-chain trading behavior and market sentiment within the Web3 ecosystem. The goal is to identify how trader actions (position size, direction, and realized PnL) correlate with emotional indicators like the Crypto Fear & Greed Index.

Two datasets were provided:

Hyperliquid Trader Data: Detailed transaction-level history including execution price, trade size, direction, timestamp, and realized PnL.

Fear & Greed Index Data: Daily sentiment scores ranging from 0 (Extreme Fear) to 100 (Extreme Greed).

The main objective was to merge both datasets, analyze behavior trends, and extract insights on trader performance under varying market emotions.

2. METHODOLOGY

a. Data Cleaning Both CSVs were loaded in Google Colab using pandas. Timestamp fields were converted to proper datetime objects and aligned to IST. Duplicates and missing values were handled appropriately. For Fear-Greed data, only timestamp, value, and classification columns were retained.

b. Feature Engineering Trader data was grouped per day using the timestamp field. Calculated daily metrics:

- Total PnL
- Total Volume (USD)
- Average Execution Price
- Trade Count

Merged trader data with the corresponding day’s Fear-Greed Index based on date.

C. Analysis Computed correlations between trader metrics (PnL, volume, position size) and sentiment score. Visualized patterns using line charts and scatter plots:

- PnL vs Sentiment
- Volume vs Sentiment
- Correlation heatmap

Created daily risk-return plots to identify how trader success varied across market emotions.

3. KEY INSIGHTS

Trader PnL and Sentiment are moderately correlated.

During Greed phases (index > 70), overall PnL and trade volume increased sharply. Suggests higher risk-taking behavior and overconfidence during bullish sentiment.

During Fear phases, traders showed: Reduced position sizes Lower overall volume Higher PnL variance — some traders performed extremely well due to volatility.

Emotional extremes (Extreme Fear or Extreme Greed) coincide with spikes in trade frequency. Indicates herd behavior — traders tend to act impulsively during sentiment extremes.

Fee impact was negligible compared to PnL fluctuations, but high-frequency trades during volatility led to noticeable fee accumulation.

Lag Effect Observed: PnL improvements were often observed 1–2 days after sentiment recovered from Fear. This suggests traders react slightly slower than overall market emotion.

4. VISUAL HIGHLIGHTS

Visualization	Description
pnl_vs_sentiment.png	Daily PnL plotted against Fear-Greed Index
volume_vs_sentiment.png	Volume (USD) vs Market Sentiment
correlation_heatmap.png	Correlation between PnL, Volume, and Sentiment
pnl_vs_index_timeseries.png	Time-series plot showing market mood and trader profitability

All visuals were exported under /outputs/ folder.

5. CONCLUSION

The analysis demonstrates a clear emotional dependency between trading behavior and market sentiment. Traders tend to take larger positions and more trades during optimistic (Greed) markets, but more disciplined and profitable trades often emerge during recovery from Fear phases.

Strategic takeaway: Trading algorithms could integrate Fear-Greed Index as a sentiment factor for position sizing. Future improvement: include blockchain wallet- level clustering to detect behavioral cohorts (retail vs whales).

6. DELIVERABLES SUMMARY

File	Description
notebook_1.ipynb	Main Colab notebook with complete code and visualizations, you can access https://colab.research.google.com/drive/1tQjXf-fLaqTinCzlORposnaMHY8hYoaY?usp=sharing
/csv_files/*.csv	Raw + processed datasets
/outputs/*.png	Visualization outputs
ds_report.pdf	This report document

7. TOOLS USED

Python: pandas, numpy, matplotlib, seaborn Google

Colab: runtime environment Libraries: datetime, matplotlib, seaborn

Visualization Tools: line plots, scatter plots, heatmaps