Trader Behavior vs Market Sentiment Analysis

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1. Introduction

Cryptocurrency markets are known for high volatility and trader sentiment swings. The Bitcoin *Fear & Greed Index* is widely used as a proxy for emotional market conditions, reflecting collective investor psychology.
At the same time, trading platforms such as **Hyperliquid** enable traders to leverage high-risk instruments, which makes behavioral understanding extremely important.

This study aims to analyze how **trader behavior and performance vary across different market sentiment regimes (Fear vs Greed)**, and whether some traders demonstrate more stable, disciplined strategies independent of sentiment shifts.

The ultimate goal is to identify:

- Which types of traders are **emotion-driven**
- Which types are **systematic and consistent**
- How sentiment impacts profitability and leverage behavior

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2. Data & Methodology

Datasets Used

Dataset	Description	Key Columns
Fear & Greed Index	Daily sentiment classification	Date, Classification (Fear/Greed)
Hyperliquid Trader Data	Individual trading event logs	account, symbol, execution price, size, side, time, closedPnL, leverage, etc.

Data Preparation Steps

1. Converted timestamps to consistent formats for accurate merging.
2. Matched each trade to the corresponding **sentiment day**.
3. Aggregated trader-level metrics:
    - Mean leverage used
    - Average trade size
    - Trade frequency
    - Realized PnL
    - Win/Loss patterns

Feature Engineering

Calculated behavioral indicators:

- Risk Appetite Score: Based on leverage + position size
- Profit Stability Score: Variance of PnL across sessions
- Behavior Shift Score: Change in performance during Fear vs Greed

Modeling

Step	Method Used	Purpose
Dimensionality Reduction	PCA	To compress correlated trader metrics
Clustering	K-Means (k=5 optimal)	To find behavioral trader groups
Validation	Silhouette Scoring	To ensure distinct cluster patterns

Selected Cluster Count:
k = 5 (Highest silhouette score = **0.2904**)

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3. Key Findings

Cluster Overview

A total of **32 unique trader accounts** were grouped into **5 clusters** based on behavior.

Cluster	Behavior Style	Sentiment Sensitivity	PnL Pattern
Cluster 0	Systematic, disciplined	**Low**	**Consistent positive returns** in both Fear & Greed
Cluster 1	Aggressive, high leverage	High	Gains in Greed, heavy losses in Fear
Cluster 2	Low frequency, cautious	Low	Small but stable PnL
Cluster 3	Overconfident during Greed	**Very High**	Performs worst during Greed
Cluster 4	Unstable / experimental	Medium	High volatility outcomes

Sentiment Impact

- During Fear markets, most traders reduced trade sizes and leverage.
- During Greed markets, many traders increased leverage excessively.
- This overconfidence effect was statistically linked to higher loss probability.

Highlighted Insight

Cluster 0 traders performed best in *both* Fear and Greed conditions.
This indicates **discipline, strategy consistency, and resistance to emotional decision-making**.

These traders represent the **ideal profile for algorithmic or model-based trading.**

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4. Conclusion

This analysis demonstrates that **market sentiment significantly influences trader performance**, especially among those who trade based on reactive or emotional decision patterns.

However, a subset of traders (**Cluster 0**) maintained **stable profitability regardless of sentiment conditions**. These traders:

- Used leverage more thoughtfully
- Maintained consistent trade sizing
- Did not chase volatility during Greed periods

Implication for Strategy Development

Future trading models should:

- Learn from Cluster 0 execution characteristics
- Avoid emotional bias seen in Clusters 1 & 3
- Implement guardrails that prevent leverage escalation during Greed markets

Recommended Next Steps

Next Step	Purpose
Time-series behavioral drift tracking	Detect when discipline decays
Feature-based trader profiling model	Classify new traders in real-time
Strategy simulation under sentiment shifts	Stress test algorithm stability