

# Data Science Report: Trading Behavior & Market Sentiment Analysis

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## Executive Summary

This report analyzes the relationship between trader behavior on the Hyperliquid platform and Bitcoin market sentiment using the Fear & Greed Index. By integrating historical trade-level data with daily sentiment classifications, the study examines how market psychology influences trading volume, profitability, trade direction, and risk behavior.

The analysis reveals that market sentiment has a measurable impact on trader activity. Periods of Greed are associated with higher trading volume and larger average trade sizes, while Fear and Extreme Fear periods show more conservative behavior and relatively lower risk exposure. These insights highlight the importance of sentiment-aware trading strategies in Web3 markets.

## 1. Introduction

### 1.1 Objective

The objective of this analysis is to understand how trader behavior—specifically trading volume, direction (BUY/SELL), profitability, and risk—aligns or diverges from overall market sentiment (Fear, Neutral, Greed).

### 1.2 Datasets Used

Dataset 1: Historical Trader Data (Hyperliquid)

Key columns:

- Account
- Coin
- Execution Price
- Size Tokens
- Size USD
- Side (BUY/SELL)
- Timestamp (IST)
- Closed PnL
- Fee

## **Dataset 2: Fear & Greed Index**

### **Key columns:**

- Date
- Classification (Extreme Fear, Fear, Neutral, Greed)
- Value

### **1.3 Methodology**

- Data cleaning and preprocessing
- Temporal alignment of trades with daily sentiment
- Exploratory Data Analysis (EDA)
- Statistical testing
- Visualization-driven insights

## **2. Data Preparation**

### **2.1 Data Cleaning**

- Converted timestamps into datetime format
- Extracted trade date for merging
- Removed records with missing critical values
- Filtered trades without sentiment mapping

### **2.2 Data Integration**

Trading data was merged with sentiment data using the trade date, ensuring that each trade was associated with the correct daily sentiment classification.

## **3. Exploratory Data Analysis**

### **3.1 Trading Volume vs Sentiment**

- Total and average trading volume (USD) was highest during Greed periods
- Fear and Extreme Fear showed comparatively lower volume
- Indicates increased market participation during optimistic sentiment

### **3.2 Buy vs Sell Behavior**

- BUY orders dominate during Greed phases
- SELL activity increases during Fear-based sentiment
- Suggests profit-taking and risk reduction during uncertain markets

### **3.3 Trade Size Distribution**

- Larger average trade sizes observed during Greed
- More consistent and smaller trades during Fear
- Reflects higher risk appetite during positive sentiment

## **4. Profitability Analysis**

### **4.1 Closed PnL by Sentiment**

- Greed periods showed higher total PnL but also greater variability
- Fear periods demonstrated lower overall PnL with relatively stable outcomes

### **4.2 Statistical Testing**

- ANOVA testing confirmed statistically significant differences in trade sizes across sentiment groups
- T-test comparison between Fear and Greed PnL showed meaningful variation in profitability

## **5. Temporal Patterns**

### **5.1 Daily Trading Activity**

- Trading frequency increases on days classified as Greed
- Neutral sentiment days show moderate, stable activity

### **5.2 Intraday Patterns**

- Peak trading activity occurs during overlapping global market hours
- Sentiment influences both trade frequency and execution timing

## **6. Risk Analysis**

### **6.1 Volatility Metrics**

- Trade size volatility is highest during Greed and Extreme Greed
- Fear-based periods show lower volatility and reduced exposure

### **6.2 Risk-Adjusted Behavior**

- Greed sentiment encourages aggressive positioning
- Fear sentiment aligns with capital preservation behavior

## **7. Advanced Insights**

### **7.1 Trader Profiling**

Traders were categorized based on activity:

- High-frequency traders dominate volume but exhibit higher volatility
- Low-frequency traders show more consistent outcomes

### **7.2 Sentiment Transitions**

- Transitions from Fear → Greed show a sharp increase in trade size
- Indicates rapid sentiment-driven behavioral shifts

## **8. Key Findings**

1. Trading volume increases significantly during Greed periods
2. Buy orders dominate optimistic sentiment phases
3. Risk exposure rises with positive sentiment
4. Fear periods encourage conservative trading behavior
5. Sentiment shifts act as early indicators of behavior change

## **9. Trading Strategy Implications**

- Sentiment-based strategies can optimize position sizing
- Contrarian opportunities exist during Extreme Fear phases
- Risk management rules should adjust dynamically with sentiment

## **10. Limitations & Future Work**

Limitations

- Leverage data availability limited
- Analysis based on historical snapshot
- External macro-economic factors not included

### **Future Enhancements**

- Include leverage and liquidation data
- Multi-asset sentiment comparison
- Real-time sentiment modeling

## **11. Conclusion**

This analysis demonstrates a clear relationship between market sentiment and trader behavior in Web3 trading environments. Traders increase volume and risk exposure during Greed phases, while Fear encourages cautious positioning. Incorporating sentiment indicators into trading strategies can improve decision-making and risk management.

The findings validate the importance of combining behavioral data with market psychology to design smarter, data-driven trading strategies.