

# Trader Behavior vs Market Sentiment

## Data Science Assignment Report

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### 1. Objective

The objective of this analysis is to study the relationship between market sentiment (Fear–Greed Index) and trader behavior using historical trade data from Hyperliquid.

Specifically, the analysis aims to understand how:

Profitability

Trade size and volume

Risk and volatility

Aggressive trading behavior

change under different market sentiment conditions (Fear, Neutral, Greed).

The goal is to uncover hidden behavioral patterns that can help design smarter, sentiment-aware trading strategies.

### 2. Datasets Used

#### 2.1 Bitcoin Market Sentiment Dataset

Source: Fear & Greed Index

Key Columns:

Date

Classification (Extreme Fear, Fear, Neutral, Greed, Extreme Greed)

The sentiment was converted into a numerical score:

Extreme Fear = -2

Fear = -1

Neutral = 0

Greed = 1

Extreme Greed = 2

#### 2.2 Historical Trader Data (Hyperliquid)

Key Columns Used:

Timestamp IST

Size USD

Closed PnL

Side

Trade ID

Fee

Crossed (market vs limit order)

Additional engineered features:

is\_profitable: Whether a trade resulted in profit

Relative Leverage (proxy): Trade size relative to average trade size

### 3. Methodology

#### 3.1 Data Preprocessing

Converted timestamps to datetime format

Standardized column names

Removed unnecessary columns

Extracted daily dates for merging datasets

### 3.2 Feature Engineering

Numerical sentiment score created from sentiment classification

Profitability indicator added (Closed PnL > 0)

Relative leverage proxy calculated using trade size

### 3.3 Data Integration

Trader data was merged with sentiment data using date as the common key, allowing daily sentiment to be mapped to trading activity.

## 4. Exploratory Data Analysis & Visual Insights

### 4.1 Market Sentiment vs Trader Profitability

Visualization: Scatter plot: Sentiment Score vs Total Daily PnL

Observation:

Positive sentiment does not always lead to higher profits

Extreme Greed periods show high variability and losses

Moderate sentiment levels are more stable

Insight:

Overconfidence during extreme greed leads to inconsistent and often negative profitability.

### 4.2 Trade Size Distribution Across Sentiment

Visualization: Boxplot: Trade Size vs Market Sentiment

Observation:

Trade sizes increase significantly during Greed and Extreme Greed

Smaller, more controlled trade sizes are observed during Fear

Insight:

Traders increase exposure during bullish sentiment, increasing risk.

### 4.3 Aggressive Trading Behavior (Crossed Orders)

Visualization: Bar chart: Proportion of Crossed (Market) Orders vs Sentiment

Observation:

Aggressive market orders are more frequent during Greed

Fear periods show more passive, cautious order placement

Insight:

Greed drives urgency and emotional trading decisions.

### 4.4 Risk Analysis (PnL Volatility)

Visualization: Bar chart: Average Absolute PnL vs Sentiment

Observation:

Highest volatility during Extreme Fear and Extreme Greed

Lower volatility during Neutral and moderate Fear

Insight:

Extreme emotions on either side increase trading risk.

## 5. Sentiment-Wise Performance Summary

Metrics analyzed:

Average PnL

Median PnL

Win rate

Average trade size

Key Patterns:

Win rate declines during Extreme Greed

Average trade size increases, but profitability does not  
Fear periods show better risk-adjusted performance

## 6. Key Findings

✓ Traders increase trade size during Greed ✓ Win rate decreases during Extreme Greed ✓ Aggressive trades increase during bullish sentiment ✓ Highest volatility occurs during extreme emotions ✓ Fear enforces discipline and better risk control

## 7. Strategic Insights

Moderate sentiment conditions offer the best trading performance. Extreme greed leads to over-leveraging and emotional decision-making, while fear enforces caution and better capital management.

Practical Trading Implications:

- Reduce position size during extreme greed
- Limit leverage when sentiment is overly bullish
- Favor structured strategies during fear
- Avoid emotional market orders during extreme sentiment

## 8. Conclusion

Market sentiment is a strong behavioral driver of trading decisions. While bullish sentiment increases trading activity, it does not guarantee profitability and often increases risk.

Incorporating sentiment awareness into:

- Position sizing
  - Leverage control
  - Order execution strategy
- can significantly improve long-term trading performance.

## 9. Reproducibility & Compliance

- All analysis performed in Google Colab
- All code shared via public Colab links
- Outputs and CSV files stored in structured directories
- Repository structure strictly follows assignment requirements