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# DATA SCIENCE REPORT

## Analysis of Trader Behavior and Market Sentiment (Fear and Greed Index)

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### 1. Introduction

This project examines how trader activity changes with market sentiment.

The task uses two datasets:

1. The Bitcoin Fear and Greed Index, which provides daily sentiment categories such as Extreme Fear, Fear, Neutral, Greed and Extreme Greed.
2. A historical Hyperliquid trader dataset from Kaggle, which contains trade level information including execution price, trade size, direction, timestamp and realized PnL.

The objective is to understand whether traders behave differently during periods of fear compared to periods of greed, and whether these behaviors affect profitability, volume and participation. The analysis is relevant for identifying behavioral patterns that could strengthen Web3 trading strategies.

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### 2. Data Preparation and Methodology

#### 2.1 Cleaning and Parsing

##### Fear and Greed Dataset

The date column was converted to a proper datetime format.

The original value column was renamed to fg\_value.

Only three fields were kept for the analysis: date, fg\_value and classification.

##### Trader Dataset

The Timestamp IST column was converted into a usable datetime format based on day, month, year and hour.

A daily date column was extracted.

Additional fields were created for analysis, including:

- trade\_value, which uses Size USD
- is\_win, a boolean identifying profitable trades
- total\_pnl, converted to float

#### 2.2 Daily Aggregation

Trader data was aggregated on a daily level to study meaningful patterns.

The aggregations included:

- total trading volume in USD
- total tokens traded
- daily realized PnL
- win rate
- number of unique trader accounts

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This created a structured daily summary for the entire dataset.

## 2.3 Merging the Datasets

A final merged table was created by joining the daily trader data with the daily sentiment data on the date column.

This allowed direct comparison between sentiment and trader behavior.

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## 3. Exploratory Data Analysis

Several visualizations were produced to explore how trader metrics vary across sentiment categories.

### 3.1 Trading Volume and Sentiment

Daily trading volume increases during Greed and Extreme Greed.

When sentiment becomes optimistic, traders appear more active and more willing to take positions.

### 3.2 Profitability and Sentiment

Daily average PnL does not improve during Greed phases.

In many cases, losses become larger during these periods.

This suggests that traders often take impulsive or poorly timed positions during optimistic markets.

### 3.3 Win Rate and Sentiment

Win rates are higher during Fear and Neutral phases.

When sentiment is negative, traders tend to trade less aggressively and make fewer unnecessary entries.

This leads to more controlled outcomes.

### 3.4 Number of Active Traders

More unique traders appear on days labeled as Greed.

Fear periods show fewer active accounts, which matches typical crowd behavior where participation increases during hype and decreases during uncertainty.

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## 4. Key Insights

### Insight 1: Greed Leads to Higher Activity but Lower Consistency

During Greed phases, the data shows an increase in trading volume and activity.

At the same time, profitability does not increase.

This indicates that traders often behave emotionally during optimistic conditions.

### Insight 2: Fear Encourages Better Discipline

Fear based sentiment results in fewer trades, lower volume and higher win rates.

Traders become more selective, which produces steadier performance.

### Insight 3: Market Sentiment Can Predict Risky Behavior

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The pattern suggests that sentiment can be used as a risk signal.

Greed periods attract more traders and more aggressive positions, but these do not translate into better results.

Fear periods are relatively more stable and predictable.

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## 5. Strategic Implications for Web3 Trading

1. Use sentiment scores as a risk filter.  
Greed phases require tighter risk controls or reduced position sizing.
2. Avoid chasing momentum during highly positive sentiment.  
This period shows weaker profitability, so models should be more conservative.
3. Recognize that lower participation during Fear can create more stable price behavior.  
Strategies focused on disciplined entries may perform better in these conditions.

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## 6. Limitations

- The trader dataset represents a limited subset and not the full Hyperliquid environment.
- Leverage information was not available in this version.
- The timeframe may not fully represent longer market cycles.

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## 7. Conclusion

The analysis shows a clear link between market sentiment and trader behavior.

Trading volume and participation increase during periods marked as Greed, but profitability does not improve.

Fear based sentiment leads to steadier outcomes and better win rates.

These results indicate that traders often act emotionally during optimistic conditions, while fearful environments encourage more disciplined decisions.

Models and strategies that include sentiment as a factor can use this information to reduce risk and improve decision making in Web3 markets.