

Analysis of Trader Behavior and Market Sentiment

A Data Science Report

Generated on: 2025-07-27

Data Source: Bitcoin Market Sentiment Dataset & Historical Trader Data from Hyperliquid

Date Range of Data: Feb 2018 - Jun 2025

1. Introduction

This report analyzes the relationship between Bitcoin market sentiment, as measured by the Fear & Greed Index, and the trading behavior observed in historical trader data from Hyperliquid. The goal is to understand how market sentiment influences trader activity and profitability, and to identify potential trends or signals.

2. Data Loading and Preprocessing

Two datasets were used for this analysis:

- - **Bitcoin Market Sentiment Dataset:** Contains daily Fear & Greed Index values and classifications.
- - **Historical Trader Data:** Contains detailed information about individual trades on the Hyperliquid platform.

Preprocessing involved converting timestamp columns to datetime objects, handling missing values (none were found), and removing redundant columns.

3. Feature Engineering

Several new features were created to facilitate the analysis:

- - Daily date extracted from timestamps.
- - Daily total trading volume (USD) per coin.
- - Daily number of trades per account.
- - Categorical trade size based on quantiles of 'Size USD' (small, medium, large, very large).

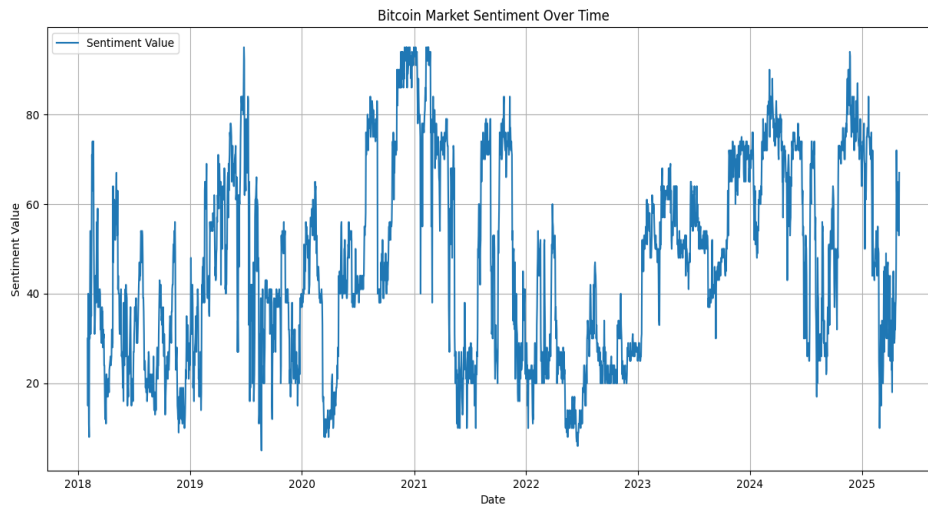
4. Data Merging

The sentiment data was merged with the aggregated daily trading volume and trade count data based on the date. This allowed for the combined analysis of market sentiment and trading activity on a daily basis.

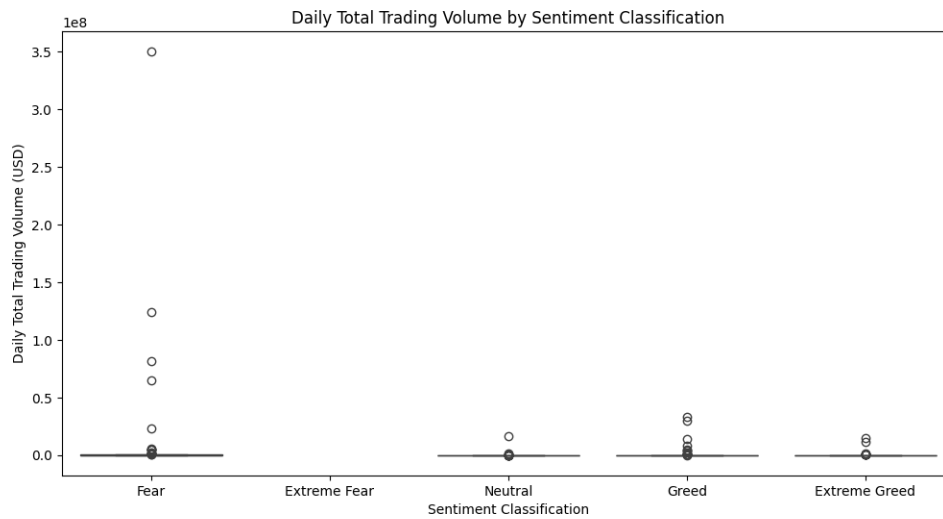
5. Exploratory Data Analysis (EDA)

Initial exploratory analysis revealed insights into the distribution of sentiment and trading activity:

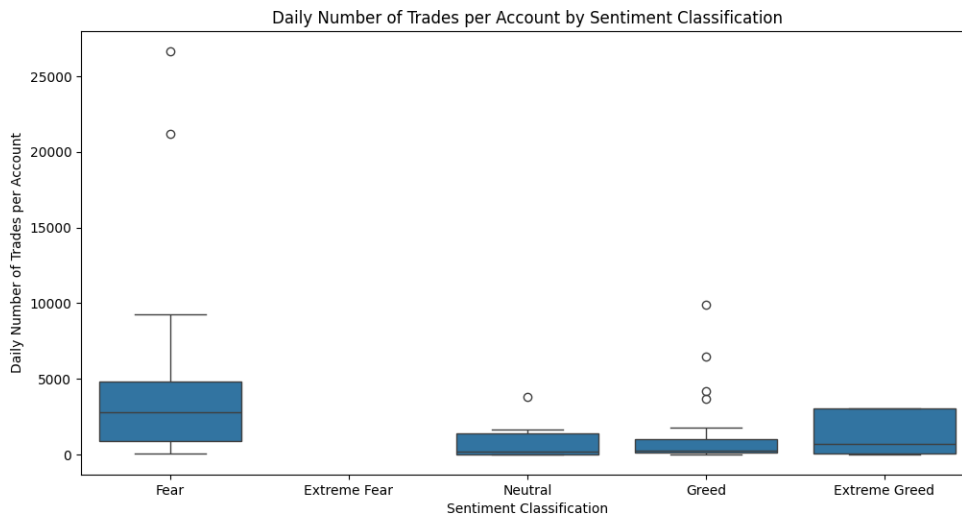
Sentiment Time Series: The plot below shows the fluctuation of the Bitcoin Fear & Greed Index over time.



Daily Total Trading Volume by Sentiment: This box plot illustrates how the distribution of daily trading volume varies across different sentiment classifications.



Daily Number of Trades per Account by Sentiment: This box plot shows the distribution of the daily number of trades per account for each sentiment classification.



6. Trader Behavior vs. Sentiment

Further analysis focused on quantifying the relationship between sentiment and key trader metrics:

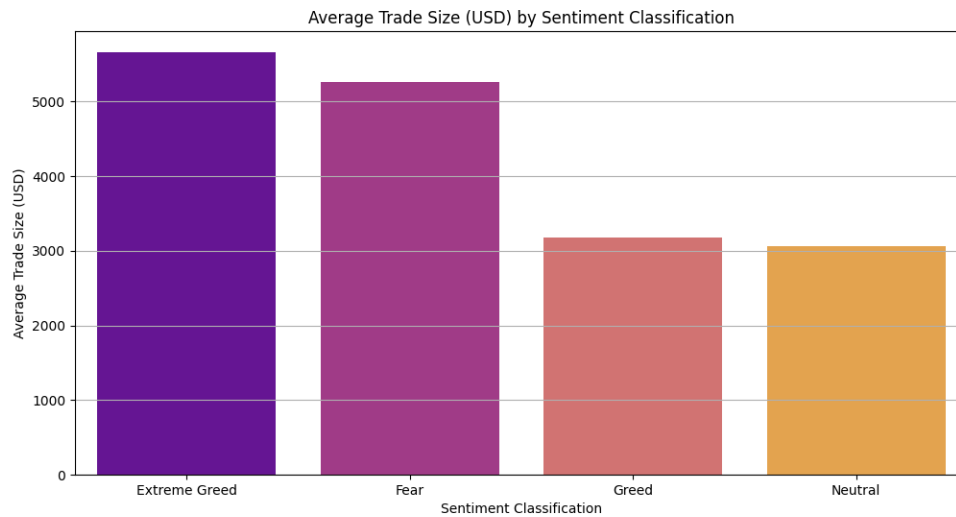
Average Closed PnL by Sentiment: The bar plot below shows the average profit and loss for trades occurring during different sentiment periods.



Average PnL by Sentiment Classification:

```
classification Closed PnL Extreme Greed 25.418772 Fear 50.047622 Greed 87.894859
Neutral 22.229713
```

Average Trade Size (USD) by Sentiment: This bar plot compares the average size of trades across different sentiment classifications.

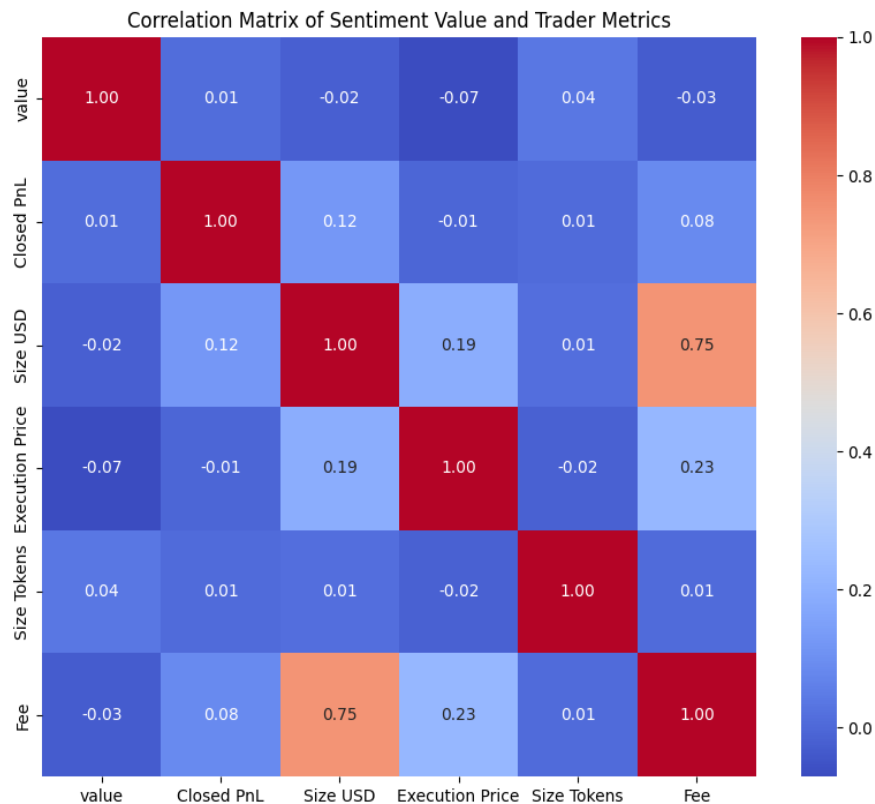


Average Trade Size (USD) by Sentiment Classification:

```
classification Size USD Extreme Greed 5660.265764 Fear 5259.977837 Greed 3182.883845  
Neutral 3058.848110
```

7. Correlation Analysis

A correlation analysis was performed to quantify the linear relationships between the numerical sentiment value and key trader metrics. The heatmap below visualizes the correlation matrix.



Correlation Matrix:

```

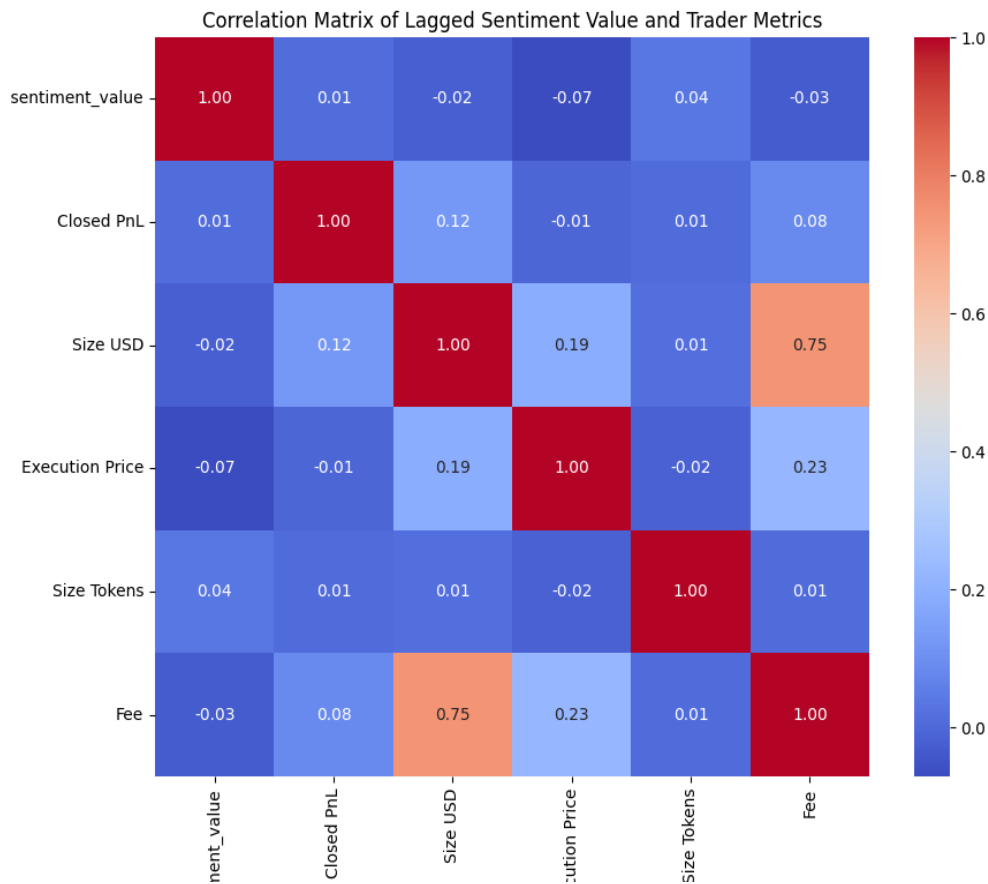
value Closed PnL Size USD Execution Price Size Tokens Fee value 1.000000 0.011132
-0.024110 -0.070793 0.035295 -0.028988 Closed PnL 0.011132 1.000000 0.123589 -0.006505
0.005068 0.084020 Size USD -0.024110 0.123589 1.000000 0.189855 0.013310 0.745939
Execution Price -0.070793 -0.006505 0.189855 1.000000 -0.017185 0.225265 Size Tokens
0.035295 0.005068 0.013310 -0.017185 1.000000 0.006710 Fee -0.028988 0.084020 0.745939
0.225265 0.006710 1.000000

```

The analysis revealed generally weak linear correlations between sentiment value and the selected trader metrics (Closed PnL, Size USD, Execution Price, Size Tokens, Fee). The strongest (though still weak) correlations with sentiment 'value' were observed with 'Execution Price' (weak negative) and 'Size Tokens' (very weak positive). These weak correlations suggest that linear relationships alone do not strongly explain the connection between sentiment and these specific trading metrics.

8. Advanced Analysis - Lagged Effects

To investigate if changes in sentiment precede shifts in trading behavior, a one-day lagged sentiment value was created and its linear correlation with trader metrics was analyzed. The heatmap below shows the correlation matrix including the lagged sentiment.



Correlation Matrix with Lagged Sentiment Value:

```

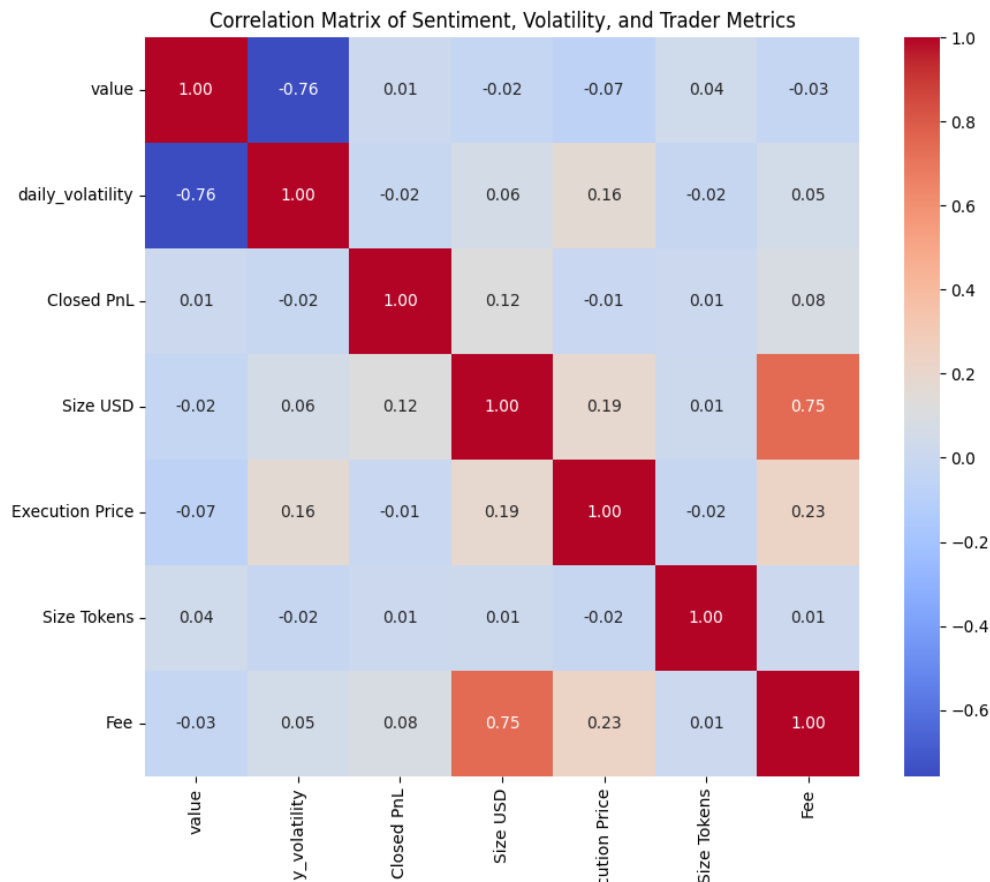
lagged_sentiment_value Closed PnL Size USD Execution Price Size Tokens Fee
lagged_sentiment_value 1.000000 0.011133 -0.024122 -0.070794 0.035294 -0.028995
Closed PnL 0.011133 1.000000 0.123589 -0.006505 0.005068 0.084020
Size USD -0.024122 0.123589 1.000000 0.189855 0.013310 0.745939
Execution Price -0.070794 -0.006505 0.189855 1.000000 -0.017185 0.225265
Size Tokens 0.035294 0.005068 0.013310 -0.017185 1.000000 0.006710
Fee -0.028995 0.084020 0.745939 0.225265 0.006710 1.000000

```

The analysis with the one-day lagged sentiment value showed very similar, and still weak, linear correlations with the trader metrics. There were no significant increases in correlation strength compared to the non-lagged analysis, suggesting that a simple one-day lagged linear relationship does not strongly predict subsequent shifts in these specific trader metrics.

9. Advanced Analysis - Volatility and Sentiment

The relationship between market volatility (measured by the daily standard deviation of execution price), sentiment, and trader behavior was analyzed. The heatmap below shows the correlation matrix including daily volatility.



Correlation Matrix including Daily Volatility:

```

value daily_volatility Closed PnL Size USD Execution Price Size Tokens Fee value
1.000000 -0.757582 0.011132 -0.024110 -0.070793 0.035295 -0.028988 daily_volatility
-0.757582 1.000000 -0.015525 0.055068 0.163980 -0.017963 0.050631 Closed PnL 0.011132
-0.015525 1.000000 0.123589 -0.006505 0.005068 0.084020 Size USD -0.024110 0.055068
0.123589 1.000000 0.189855 0.013310 0.745939 Execution Price -0.070793 0.163980
-0.006505 0.189855 1.000000 -0.017185 0.225265 Size Tokens 0.035295 -0.017963 0.005068
0.013310 -0.017185 1.000000 0.006710 Fee -0.028988 0.050631 0.084020 0.745939 0.225265
0.006710 1.000000

```

This analysis revealed a strong negative linear correlation (-0.76) between Sentiment Value and Daily Volatility, indicating that fearful periods tend to be more volatile, while greedy periods tend to be less volatile. However, daily volatility showed only weak linear correlations with average Closed PnL (0.02) and Size USD (0.06), similar to the weak correlations observed between sentiment value and these trader metrics.

10. Advanced Analysis - Sentiment and Specific Trading Patterns

An investigation was conducted to see if certain trading patterns or directions were more prevalent or profitable during specific sentiment periods ('Fear' and 'Greed').

Analysis during 'Fear' periods (Sentiment Value ≤ 30):

Based on the provided dataset, no trading data points were found within the defined 'Fear' sentiment periods (value ≤ 30). Therefore, a detailed analysis of trading patterns and profitability specifically during fearful market conditions could not be performed using this dataset.

Analysis during 'Greed' periods (Sentiment Value ≥ 80):

During periods of 'Greed', the analysis of trading directions and average profitability provided some insights:

Distribution of Trading Direction during 'Greed' periods (%):

```
Direction Close Long 34.314852 Close Short 27.736283 Open Long 19.232979 Open Short 16.001149 Buy 1.264005 Sell 1.077277 Long > Short 0.186728 Short > Long 0.186728
```

Average Closed PnL by Trading Direction during 'Greed' periods:

```
Direction Closed PnL Buy 0.000000 Close Long 37.634445 Close Short 43.706135 Long > Short 63.958684 Open Long 0.000000 Open Short 0.000000 Sell 0.000000 Short > Long 140.676320
```

During 'Greed' periods, the most common trading directions were 'Close Long' and 'Close Short', suggesting traders were actively managing existing positions. 'Open Long' and 'Open Short' were also notable. Among these more frequent directions, both 'Close Long' and 'Close Short' showed positive average Closed PnL. Less frequent directions like 'Short > Long' and 'Long > Short' showed the highest average PnL, though this is based on a small number of trades. 'Buy', 'Sell', 'Open Long', and 'Open Short' had an average Closed PnL of 0.0 in this sample during Greed periods, potentially indicating profitability is realized upon closing or trades weren't closed within the data timeframe.

11. Conclusion and Future Work

Summary of Insights:

The analysis provided several insights into the relationship between Bitcoin market sentiment and trader behavior on Hyperliquid:

- - Average trading volume appears to be higher during periods of strong market emotion (Extreme Greed and Fear).
- - Average profitability (Closed PnL) was highest during 'Greed' periods, but notable profits were also observed during 'Fear'.
- - A strong negative linear correlation exists between Sentiment Value and Daily Volatility: Fearful periods are more volatile, and greedy periods are less volatile.
- - Linear correlations between the numerical sentiment value and key trading metrics (including lagged sentiment and volatility) were generally weak, suggesting that simple linear relationships do not fully capture the complex dynamics.

- - Analysis of specific trading patterns during 'Greed' periods showed that closing positions ('Close Long', 'Close Short') were common and profitable on average. Analysis for 'Fear' periods was not possible due to data limitations.

Limitations:

The analysis has some limitations:

- - The Fear & Greed Index is a composite indicator and may not capture all nuances of market sentiment.
- - The correlation analysis focused primarily on linear relationships; non-linear patterns may exist.
- - The analysis did not account for the timing of trades within a day or different lagged effects of sentiment/volatility on trading behavior.
- - A significant limitation was the lack of trader data available within the 'Fear' sentiment periods in the provided dataset, preventing a comparative analysis of trading patterns during fearful market conditions.

Future Work:

Future analysis could explore:

- - Non-linear relationships and advanced time-series analysis (e.g., Granger causality, VAR models) to identify more complex lagged effects and predictive signals.
- - Analysis of specific trading strategies or patterns across various sentiment and volatility regimes, potentially requiring more granular or different types of trader data.
- - Incorporating other market indicators (e.g., price action, volume profiles, on-chain data) or news sentiment data.
- - Analyzing trader behavior at a more granular level (e.g., intraday patterns, order book data).
- - Obtaining a dataset with trader activity that covers periods of low sentiment to enable a comprehensive comparative analysis.