Data Science Report: Relationship Between Bitcoin Market Sentiment and Trader Behavior

1. Introduction

This report details an analysis of the relationship between Bitcoin market sentiment, as indicated by the Crypto Fear and Greed Index, and the trading behavior of users on the Hyperliquid platform. The primary objective is to identify correlations, patterns, and potential signals within the data that could contribute to the development of more informed and effective trading strategies.

2. Data Overview

The analysis utilized two datasets:

- **Historical Trader Data from Hyperliquid**: This dataset contains granular trade-level information, including `Account` identifiers, `Coin` symbols, `Execution Price`, `Size Tokens`, `Size USD`, `Side` (BUY/SELL), `Timestamp IST`, `Start Position`, `Direction`, `Closed PnL`, `Transaction Hash`, `Order ID`, `Crossed`, `Fee`, and `Trade ID`. The `Timestamp` column, in milliseconds epoch format, was crucial for temporal analysis.
- **Bitcoin Market Sentiment Dataset**: This dataset provides daily sentiment data, including a numerical `value` (0-100) and a `classification` (Extreme Fear, Fear, Neutral, Greed, Extreme Greed), along with a `timestamp` and `date`.

3. Data Cleaning and Preprocessing

The raw data underwent the following preprocessing steps:

- Timestamps in both datasets were converted to datetime objects, and the date was extracted for alignment.
- Rows with missing date information were removed.

- The `historical_data_df` was aggregated to a daily level to align with the sentiment data. Daily metrics calculated include:
    - Daily trading volume (sum of 'Size USD').
    - Number of trades (count of 'Account' or rows).
    - Total closed PnL (sum of 'Closed PnL').
    - Proportion of winning, losing, and neutral trades based on 'Closed PnL'.
- The daily trading metrics were merged with the daily sentiment data based on the date.

(Note: Daily average leverage could not be calculated due to the absence of explicit account size or margin information in the historical trading dataset.)

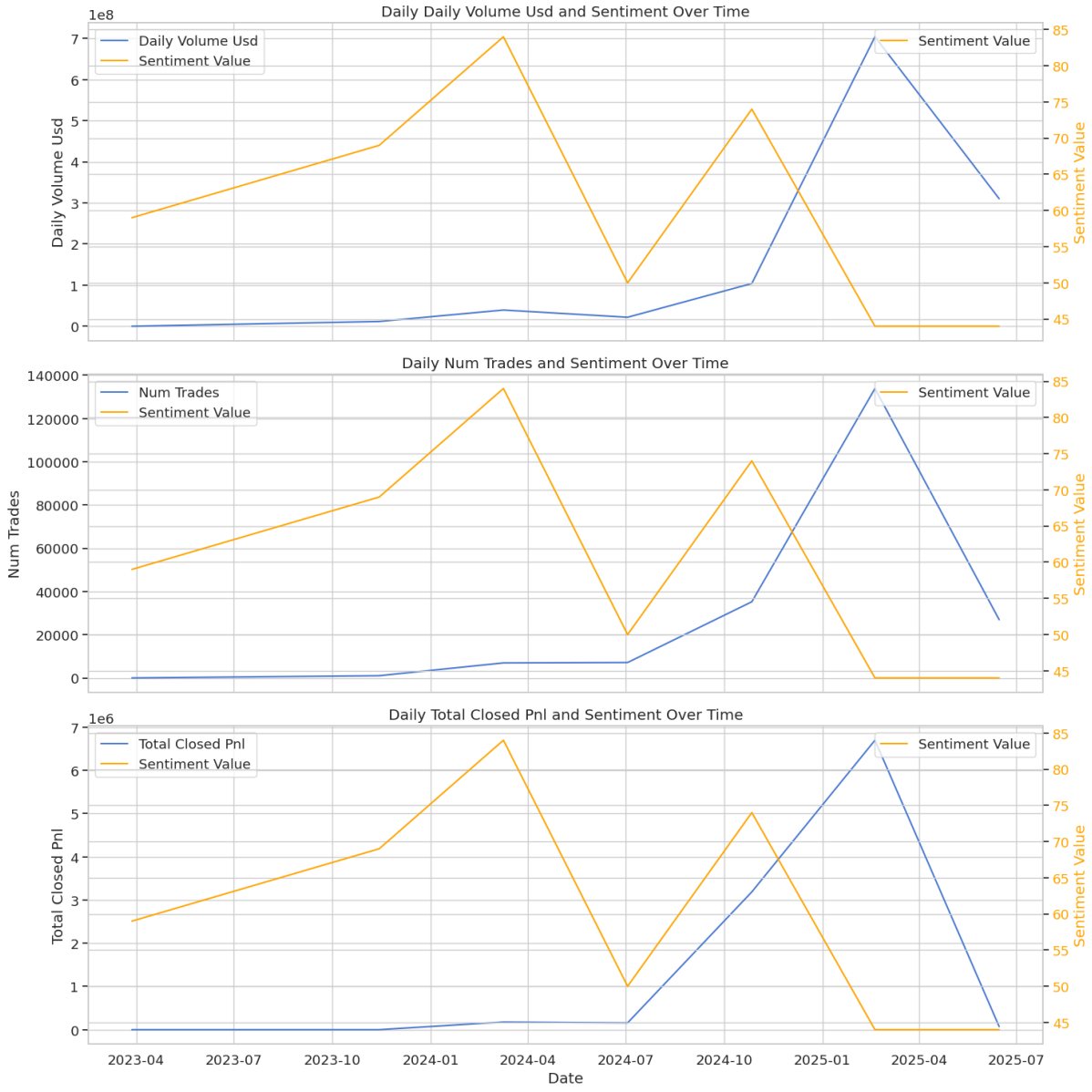
4. Analysis of Relationship between Sentiment and Trading Behavior

4.1. Daily Trading Metrics by Sentiment Classification

Analysis of the mean daily trading metrics across different sentiment classifications revealed notable patterns:

- **Daily Volume USD and Number of Trades**: Contrary to intuitive expectations, periods classified as **'Fear'** exhibited the highest mean daily trading volume and number of trades. This suggests heightened activity during market downturns, potentially driven by panic or opportunistic trading.
- **Total Closed PnL**: The highest mean total closed PnL was observed during **'Fear'** sentiment, followed by 'Greed'. This indicates that despite negative sentiment, these periods may offer significant profit potential for some traders.
- **Proportion of Winning/Losing/Neutral Trades**: 'Extreme Greed' showed the highest mean proportion of winning trades, but also a relatively high proportion of losing trades. 'Greed' and 'Neutral' periods had a higher proportion of neutral

trades.



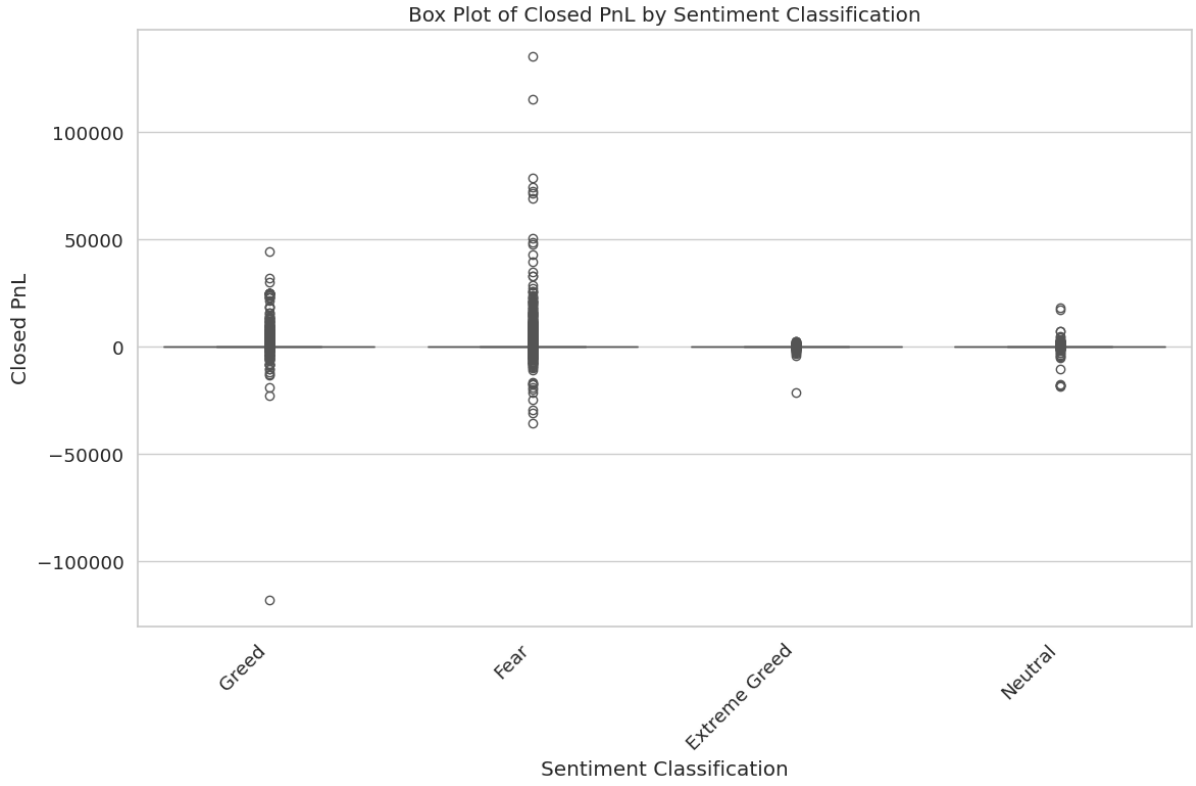
5. Identifying Hidden Trends and Signals

5.1. PnL Distribution by Sentiment

Visualizing the distribution of 'Closed PnL' using violin and box plots provided insights into the variability and potential for extreme outcomes:

- The median PnL was generally around zero across all classifications.

- 'Fear' and 'Extreme Greed' sentiments were associated with wider PnL distributions and a higher frequency of significant positive and negative outliers, indicating increased volatility and potential for large gains or losses during these periods.



5.2. Strategy Performance by Sentiment

Analyzing the performance of different trading strategies (defined by 'Side' and 'Direction') within each sentiment classification revealed varying profitability:

- Strategies involving closing positions ('Close Short', 'Close Long') generally showed positive mean PnL.
- The 'Close Short' strategy demonstrated a particularly high mean PnL during 'Fear' sentiment, aligning with the overall observation of higher profitability during fearful periods.

5.3. Lead-Lag Relationship Exploration

Examining the correlation between lagged sentiment value (sentiment from the previous day) and current day's trading metrics suggested a potential inverse relationship:

- Negative correlations were found between lagged sentiment value and daily volume, number of trades, and total closed PnL.
- This implies that higher sentiment (greed) on one day might precede a decrease in trading activity and profitability on the subsequent day, while lower sentiment (fear) might precede an increase. This could serve as a 'contrarian' signal.

5.4. Time Series Visualization

Time series plots of key trading metrics overlaid with sentiment values visually supported the findings:

- Peaks in daily trading volume and number of trades often coincided with periods of lower sentiment (fear).
- Higher total closed PnL also sometimes aligned with or followed dips in sentiment.
- Periods of high sentiment (greed) often appeared less volatile in terms of trading activity or preceded a decline.

(Include visualizations here: Time Series Plots of Daily Trading Metrics and Sentiment Over Time)

6. Potential Signals for Smarter Trading Strategies

Based on the analysis, the following potential signals and strategic considerations are suggested:

- **Contrarian Approach**: Periods of 'Fear' or 'Extreme Fear' may present favorable opportunities due to observed higher activity and PnL. Trading against the prevailing extreme sentiment could be a viable strategy.
- **Strategy Specificity**: Adapting trading strategies based on the current sentiment classification could improve outcomes. For instance, focusing on closing short positions during fearful periods.
- **Volatility Management**: Recognizing that 'Fear' and 'Extreme Greed' are associated with higher PnL variability requires robust risk management strategies during these times.
- **Lagged Sentiment as an Indicator**: Considering the previous day's sentiment as a potential inverse indicator for expected current day's market activity and profitability.

7. Conclusion

The analysis reveals a compelling relationship between Bitcoin market sentiment and trader behavior on Hyperliquid. Notably, 'Fear' sentiment correlates with increased trading activity and higher total PnL, challenging conventional wisdom. The observed potential lead-lag relationship further suggests that sentiment, particularly at extremes, might act as a predictive signal. Incorporating sentiment analysis, potentially with a contrarian perspective, into trading strategies could lead to more informed decision-making. Further research using more advanced time series analysis could strengthen these findings.