Trader Behavior Analysis Based on Market Sentiment

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1. Introduction

Market sentiment plays a crucial role in influencing trader behavior, particularly in highly volatile markets such as cryptocurrency. Emotional factors like fear and greed often drive decision-making, impacting risk appetite, position sizing, and profitability.

The objective of this project is to analyze how Bitcoin market sentiment, measured using the Fear & Greed Index, affects trader behavior on the Hyperliquid trading platform. By integrating historical trade-level data with daily sentiment indicators, this analysis aims to uncover patterns that can support more informed and risk-aware trading strategies.

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2. Dataset Description

2.1 Historical Trader Data (Hyperliquid)

The trader dataset contains approximately **61,000 executed trades**, with key attributes including:

- Execution price
- Trade size in USD
- Trade direction
- Realized profit and loss (Closed PnL)
- Unix-based timestamps

The data represents real trading activity over an extended time period and reflects diverse market conditions.

2.2 Bitcoin Fear & Greed Index

The sentiment dataset provides **daily market sentiment classifications**, including:

- Sentiment score
- Sentiment category (Fear, Neutral, Greed, Extreme Greed)
- Date

This dataset captures the emotional state of the Bitcoin market on a daily basis.

3. Data Cleaning and Preprocessing

Several preprocessing steps were performed to ensure data consistency and analytical accuracy:

- **Column standardization** was applied to maintain consistent naming conventions.
- **Unix timestamps** in the trader dataset were converted into datetime format.
- Both datasets were **aligned at a daily level** using normalized date values.
- Trades with missing realized PnL values were removed to maintain data quality.

These steps ensured reliable integration between trade-level data and daily sentiment indicators.

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4. Feature Engineering

To enable behavioral analysis, the following features were engineered:

- **Trade Size (USD):** Used to assess position sizing behavior.
- **Loss Indicator (is_loss):** Identifies whether a trade resulted in a loss.

These features allowed for clearer evaluation of risk-taking and performance across different sentiment phases.

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5. Data Integration

The cleaned trader data was merged with the sentiment dataset using an **inner join on normalized dates**. The final merged dataset retained a balanced distribution across sentiment categories.

Trade distribution across sentiment phases was approximately:

- **Greed:** ~50%
- **Fear:** ~23%
- **Extreme Greed:** ~13%
- **Neutral:** ~12%

This distribution reflects increased trading activity during optimistic market conditions.

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6. Exploratory Data Analysis and Results

6.1 Profitability vs Market Sentiment

Analysis of realized PnL reveals that traders achieve the highest average profitability during **Greed** phases, with an average PnL of approximately **$88 per trade**.
In comparison:

- Fear periods show lower average profitability at around **$50 per trade**
- Neutral sentiment results in comparatively modest returns

This indicates that optimistic sentiment environments are generally more favorable for profitability.

6.2 Loss Frequency vs Market Sentiment

Loss frequency analysis shows that:

- **Extreme Greed** periods have the highest loss rate at approximately **13%**
- Fear and Greed phases exhibit lower loss frequencies, around **8–9%**

This suggests that excessive optimism may increase volatility and inconsistent outcomes despite higher trading activity.

6.3 Trade Size vs Market Sentiment

Trade sizing behavior varies significantly across sentiment categories:

- Average trade size peaks during **Extreme Greed** at approximately **$5.6k**
- Fear periods also show relatively high trade sizes (~$5.2k)
- Greed and Neutral phases maintain more moderate position sizes (~$3k)

This pattern highlights increased risk exposure during emotionally driven market phases.

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7. Key Insights

- Market sentiment strongly influences trader risk appetite and behavior.
- Greed phases are associated with higher profitability and increased activity.
- Extreme Greed leads to larger trade sizes but higher loss frequency.
- Fear-driven markets show cautious behavior and reduced profitability.

8. Conclusion

This analysis demonstrates that Bitcoin market sentiment has a measurable impact on trader behavior on the Hyperliquid platform. While Greed phases offer higher profitability, Extreme Greed introduces elevated risk and volatility. Conversely, Fear phases tend to suppress returns and increase loss probability.

Incorporating sentiment-aware risk management strategies—such as dynamic position sizing or exposure limits—could help traders optimize performance while reducing downside risk during emotionally charged market conditions.

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9. Future Scope

Future extensions of this analysis could include:

- Trader-level consistency and performance tracking
- Lagged sentiment impact analysis
- Integration of leverage and volatility metrics