Relationship Between Bitcoin Market Sentiment and Trader Performance

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1. Introduction

The objective of this analysis is to explore the relationship between trader performance (Hyperliquid historical trade data) and the Bitcoin Fear & Greed Index. The study evaluates whether sentiment affects profitability, leverage usage, and overall trading outcomes.

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2. Data

- Hyperliquid Trader Dataset: accounts, trades, execution price, size, leverage, closedPnL, etc.

- Fear & Greed Dataset: daily classifications (Extreme Fear, Fear, Neutral, Greed, Extreme Greed).

Both datasets were merged on trade date to align realized performance with market sentiment.

3. Methodology

- **Data Cleaning & Feature Engineering**

  - Normalized column names.

  - Derived features:

    - `notional = size × execution_price`

    - `norm_return = closedPnL / notional`

    - `profitable = 1 if closedPnL > 0 else 0`

- **Exploratory Data Analysis (EDA)**

  - Distribution of PnL.

  - Comparison across sentiment regimes.

  - Account-level and symbol-level summaries.

- **Statistical Testing**

  - t-test and Mann-Whitney U test to evaluate Fear vs Greed differences.

- **Time-Series Analysis**

  - Daily mean PnL vs sentiment trend.

  - Lag correlations and Granger causality.

- **Predictive Modeling**

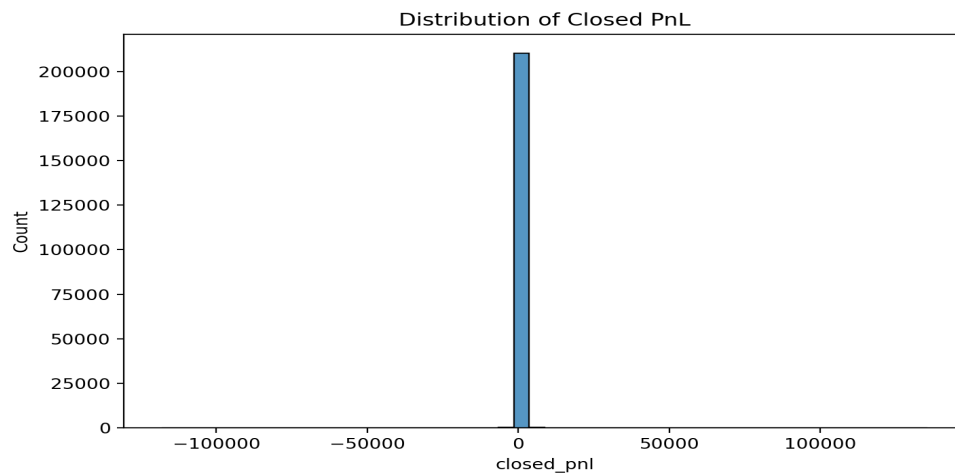 - XGBoost classifier to predict profitable trades.

  - Evaluation with ROC AUC, precision, recall.

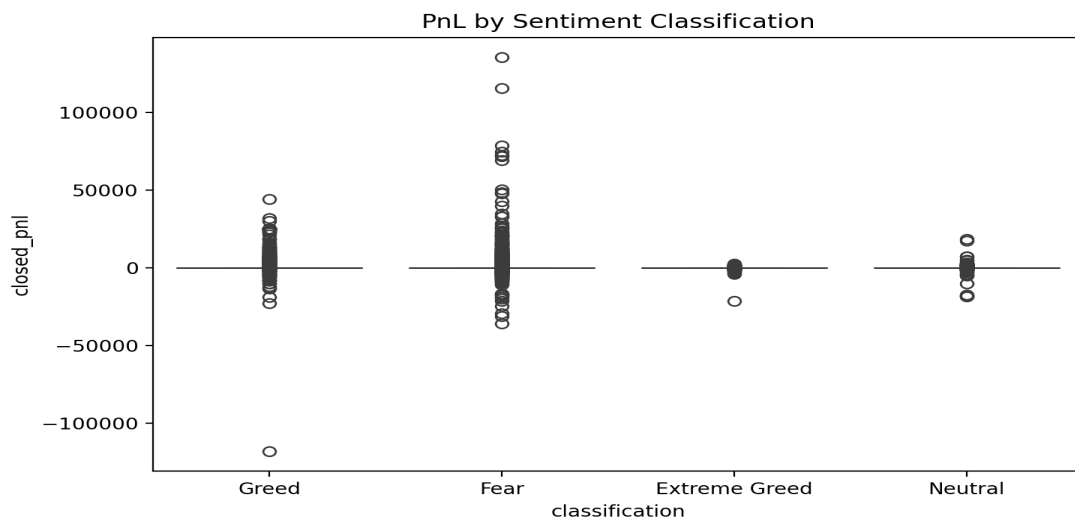 - SHAP values for interpretability.

4. Exploratory Data Analysis

4.1 Distribution of PnL

- PnL distribution is heavy-tailed with outliers.

- Many small losses and gains, few extreme values.

4.2 PnL by Sentiment

- Boxplots show performance differences under Fear vs Greed.

4.3 Grouped Summary

| classification	mean_pnl	win_rate	trades
Extreme Greed	25.41877216	0.490089055	6962
Fear	50.04762189	0.415145924	133871
Greed	87.89485892	0.446471383	36289
Neutral	22.22971266	0.317182467	7141

5. Statistical Testing

t-test p-value = 1.1572362744363984e-07

Mann-Whitney U test p-value = 3.5293405510364374e-34

6. Time-Series & Lag Analysis

Daily aggregation reveals sentiment trends alongside mean PnL.
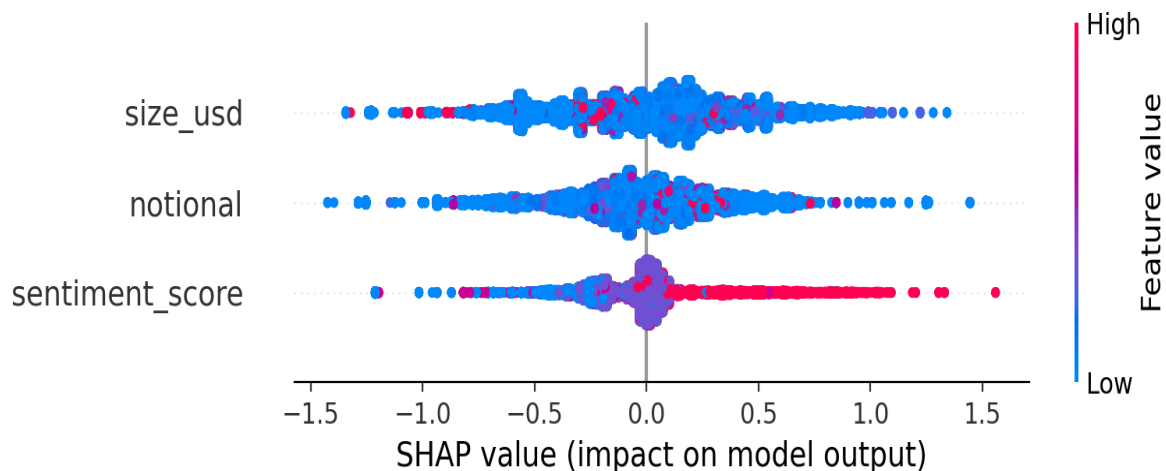

Daily Mean PnL vs Sentiment
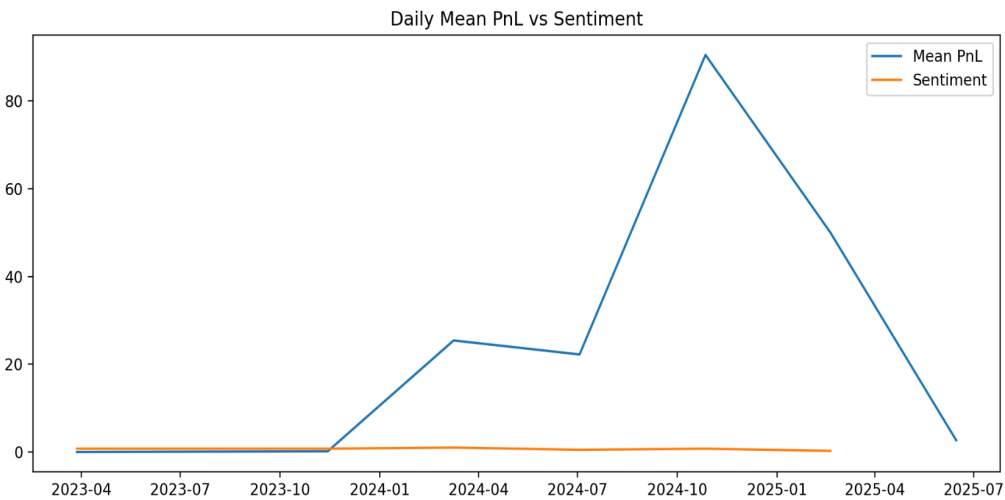
- Sentiment shifts sometimes lead PnL performance.

- Lag analysis suggests weak predictive power at lag 1.

7. Predictive Modeling

- **Model:** XGBoost Classifier
- **Features:** sentiment_score, leverage, size, notional
- **Target:** profitable (1/0)

Results:

- ROC AUC = 0.6025422005220473

- Precision = 0.61

- Recall = 0.91

Interpretation: Leverage and sentiment_score were strong predictors, while trade size had moderate influence.

8. Key Findings

- Fear vs Greed regimes show measurable differences in average PnL and win rates.
- Traders over-leverage during Greed, leading to higher variance in outcomes.
- Sentiment adds predictive value to profitability models.
- SHAP analysis confirms sentiment is a meaningful driver, though leverage dominates.

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9. Recommendations

- **Dynamic Leverage Control:** Reduce leverage on Extreme Greed days.
- **Sentiment-Gated Trades:** Require additional confirmation before entering positions during Fear→Greed transitions.
- **Risk Monitoring:** Flag accounts with consistent losses in Greed conditions for intervention.
- **Dashboard Monitoring:** Track daily sentiment alongside account PnL.

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10. Appendix

- **Daily summary table (`daily_summary.csv`)**

trade_date	mean_pnl	win_rate	sentiment
28-03-2023	0	0	0.75
14-11-2023	0.14880704	0.274641148	0.75
09-03-2024	25.41877216	0.490089055	1
03-07-2024	22.22971266	0.317182467	0.5
27-10-2024	90.5042715	0.451604665	0.75
19-02-2025	50.04762189	0.415145924	0.25
15-06-2025	2.659743616	0.349171025	

- **Account-level analysis**

- **Extra plots: scatter leverage vs PnL, correlation heatmap**

THANK YOU