1. Introduction

The cryptocurrency market is not merely shaped by fundamentals and technicals; it is **psychology-driven**. Traders often oscillate between **fear**, where risk aversion dominates, and **greed**, where overconfidence fuels aggressive risk-taking. The **Bitcoin Fear & Greed Index** quantifies this sentiment into a simple classification, while trade-level data from Hyperliquid captures actual trader actions.

This project investigates the **alignment and divergence** between market sentiment and trader behavior. Specifically, we seek to address three guiding questions:

- **Do traders behave differently during fear vs. greed phases?**
- **How do leverage, trading volume, and profitability interact with market sentiment?**
- **Can sentiment itself be used as a predictive or contrarian trading signal?**

By merging sentiment indices with granular trading data, this study explores whether collective mood translates into systematic trading behaviors and whether these behaviors can be harnessed for better trading strategy design.

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2. Data Preparation

2.1 Datasets Used

1. **Hyperliquid Historical Trader Data (trade-level):**
    - Key fields: account, symbol, execution price, size, side, time, closedPnL, leverage.
    - Provides a granular view of how individual traders acted: position sizes, profitability, risk, and activity timing.

2. **Bitcoin Fear & Greed Index:**
    - Fields: Date, Classification (Fear / Greed), Value (0–100).
    - A proxy for collective market psychology, derived from volatility, social media activity, dominance, and market trends.

2.2 Cleaning Steps

To ensure reliability, the following steps were performed:

- **Timestamp normalization:** All trade times were converted to **UTC daily format**, enabling alignment with sentiment data.
- **Duplicate & missing removal:** Redundant rows were dropped; missing values in leverage or PnL were imputed where possible or removed if anomalous.
- **Anomaly filtering:** Trades with unrealistic leverage (e.g., > 100x) or implausible PnL outliers were excluded.
- **Column standardization:** Unified column naming (e.g., Execution Price → execution_price) for ease of aggregation.

2.3 Feature Engineering

New daily-level features were computed:

- **total_volume** = Σ (|size| × execution_price) per day
- **avg_leverage** = average leverage of all trades in a day
- **net_pnl** = total closedPnL per day
- **unique_traders** = number of distinct accounts active per day

The Fear & Greed Index classification (Fear / Greed) was then merged by date with these daily aggregates, producing a **unified dataset of sentiment + trading behavior**.

3. Exploratory Data Analysis (EDA)

3.1 Profitability vs Sentiment

- **Observation:** During **Greed phases**, median profitability was **lower**, even though total trading activity increased.
- **Implication:** Greed-driven overconfidence pushes traders into riskier positions without disciplined exits, eroding returns.

3.2 Volume & Participation

- **Observation:** Total trading volume and number of active accounts surged during Greed days.
- **Implication:** Market optimism attracts more traders, often latecomers chasing momentum — an indicator of herd behavior.

3.3 Leverage Usage

- **Observation:** Average leverage peaked during Greed phases, at times beyond sustainable levels.
- **Implication:** Traders amplify exposure in bullish sentiment, but this magnifies volatility and accelerates liquidation risk.

3.4 Sentiment Correlation Heatmap

Correlation analysis revealed:

- **Positive correlation:** Sentiment value ↔ Volume, Leverage
- **Negative correlation:** Sentiment value ↔ Net Profitability
- **Interpretation:** Sentiment drives risk appetite, but optimism does **not** guarantee profits; in fact, high sentiment often precedes losses.

4. Key Findings

1. **Greed leads to overconfidence:**
   Higher leverage and larger positions are common during greed, but these do not translate into higher profitability.

2. **Fear encourages discipline:**
   In fear phases, traders reduced exposure, but losses were smaller and returns more consistent.

3. **Contrarian signal from Extreme Greed:**
   The day following extreme greed often saw **net negative PnL** across traders. This provides a potential short-term contrarian trading signal.

4. **Volume spikes as risk indicators:**
   Sudden increases in trading volume (especially in greed) preceded periods of elevated losses.

5. Recommendations

- **Use Fear & Greed as a contrarian tool:**
  Avoid entering highly leveraged positions on days of extreme greed.

- **Risk management framework:**

  - Cap leverage usage during greed phases.
  - Implement stop-loss mechanisms to prevent amplified losses.

- **Volume-based monitoring:**
  Treat abnormal spikes in participation as warning signals of herd behavior and potential reversals.

- **Strategy alignment:**

  - During fear → focus on accumulation/longer-term entries.
  - During greed → adopt contrarian or defensive trading stance.

6. Conclusion

This study confirms that cryptocurrency trader behavior is deeply influenced by sentiment:

- **Greed fuels overconfidence** → higher leverage, higher volume, but lower profitability.
- **Fear fosters caution** → lower exposure, steadier outcomes.
- **Extreme Greed provides contrarian opportunities** → following such phases, markets tend to correct.

In practical application, integrating the Fear & Greed Index into algorithmic systems or discretionary trading frameworks can act as a **behavioral risk filter**. By acknowledging that sentiment drives collective mistakes, traders can avoid herd pitfalls and time entries more effectively.

Ultimately, **sentiment is not a direct buy/sell signal**, but a **contextual overlay** that enhances risk-adjusted performance.