Analysis Report: Bitcoin Market Sentiment and Trader Performance on Hyperliquid

1. Introduction

This report investigates the relationship between **Bitcoin market sentiment** and **trader performance** on the **Hyperliquid** trading platform.
The goal is to uncover whether shifts in market sentiment (Fear/Greed) influence trader profitability and to derive insights that can guide smarter trading strategies in the Web3 environment.

2. Data Description

Two primary datasets were used:

- **Bitcoin Market Sentiment Data (Fear-Greed Index)**
    - Columns: Date, Classification, Value
    - Represents daily sentiment classifications ranging from *Extreme Fear* to *Extreme Greed*.
- **Historical Trader Data from Hyperliquid**
    - Columns include: account, symbol, execution_price, size, side, direction, crossed, closedPnL, start_position, leverage, etc.
    - Represents individual trading activities and profitability metrics.

Preprocessing steps included:

- Converting timestamps to datetime format
- Aggregating trader performance by day
- Calculating daily sentiment change and merging datasets on date
- Creating a proxy for trader performance using the average daily ClosedPnL

3. Methodology

1. **Feature Engineering**
    - Computed **daily average trader performance** using mean ClosedPnL

- Calculated **daily sentiment change** (difference in daily average sentiment value)
- Merged both datasets on date

2. **Exploratory Data Analysis (EDA)**
   - Time-series visualization of daily trader performance vs. sentiment values
   - Scatter plots of sentiment change vs. average trader performance
   - Classification-based aggregation (Extreme Fear → Extreme Greed)
3. **Statistical Analysis**
   - Pearson correlation to measure linear relationship
   - Linear regression (OLS) to quantify predictive relationship
   - Evaluation using MSE and R^2 metrics
4. **Classification-Level Analysis**
   - Compared average ClosedPnL and trade behavior (BUY/SELL, Direction, Crossed) across sentiment classifications

4. Key Findings

Statistical Results

- **Pearson Correlation Coefficient:** ≈ **0.150** → Weak positive linear relationship
- **R-squared (Linear Regression):** ≈ **0.018** → Only 1.8% of variance in trader performance is explained by sentiment change
- **Mean Squared Error (MSE):** ≈ **491.91** → Indicates a significant gap between predicted and actual trader performance

Trade & Sentiment Insights

- **Direction Performance:**
  - *Auto-Deleveraging* → Highest positive mean ClosedPnL
  - *Liquidated Isolated Short* → Large negative mean ClosedPnL
- **Classification Behavior:**

    - *Extreme Greed* had the **highest average sentiment value and ClosedPnL**
    - *Extreme Fear* had the **lowest average performance values**
- **Trade Distribution Patterns:**
    - More **SELL** trades during *Extreme Greed* phases
    - **Crossed trades** more frequent across all sentiment classifications
- **Temporal Trends:**
    - Alternating periods of *Fear* and *Greed* dominated the time series, reflecting cyclical market behavior

5. Insights and Interpretation

- **Sentiment as a Weak Predictor:**
  Although statistically significant, sentiment change explains only a small portion of trader performance variation.
- **Limited Predictive Power:**
  A simple model using only sentiment data is insufficient for performance forecasting.
- **Dominant External Factors:**
  Technical signals, risk management, and market volatility likely influence trader outcomes more strongly than sentiment alone.
- **Strategic Use:**
  Sentiment can serve as a **complementary indicator**, enhancing multi-factor trading models rather than acting as a primary driver.

6. Recommendations / Next Steps

1. **Feature Expansion:** Add technical indicators (RSI, MACD, volume, volatility, etc.)
2. **Model Improvement:** Explore non-linear models (Random Forest, XGBoost, or LSTM)
3. **Segmentation:** Analyze sentiment impact across trader types (by volume or leverage)

4. **Lag Effects:** Examine delayed influence of sentiment on performance (T+1, T+2 days)
5. **Extreme Cases:** Study behavior under *Extreme Fear* or *Extreme Greed* specifically
6. **Visualization:** Develop Power BI dashboards for real-time sentiment-performance tracking

7. Conclusion

The analysis found a **weak but statistically significant** relationship between Bitcoin sentiment and trader performance on Hyperliquid.
While sentiment indicators provide contextual understanding, they **cannot independently predict trading outcomes**.
Future research combining sentiment with advanced quantitative metrics and behavioral factors will better capture the dynamics of trader success in volatile crypto markets.

8. Submission Summary

Deliverables:

- bitcoin_sentiment_analysis.ipynb (analysis notebook)
- Analysis_Report.txt / README.md (summary report)
- data/ folder (sample CSVs or preprocessed outputs)