Analysis of Trader Behaviour and Market Sentiment

This report details the analysis of the relationship between trader behaviour and market sentiment, using the Bitcoin Market Sentiment Dataset and Historical Trader Data from Hyperliquid. The primary goal is to uncover hidden trends and provide insights that can inform smarter trading strategies.

Data Processing and Preparation

The first step was to prepare the data for analysis. This involved several key actions:

- **Data Loading**: The two datasets, fear_greed_index.csv and historical_data.csv, were loaded into pandas DataFrames.
- **Timestamp Conversion and Merging**: The 'Timestamp IST' column from the historical trader data and the 'date' column from the sentiment data were both converted to a standardized datetime format. This allowed for a successful left merge of the two datasets, combining them into a single DataFrame for unified analysis.
- **Feature Selection**: To focus the analysis, several columns were deemed irrelevant and dropped from the merged DataFrame. These included 'Account', 'Coin', 'Timestamp IST', 'Start Position', 'Transaction Hash', 'Order ID', 'Trade ID', and 'Crossed'.
- **Handling Missing Data**: The final step in data cleaning was to remove any rows containing null values to ensure the quality and integrity of the analysis.

Exploratory Data Analysis: Key Findings

The analysis focused on four main areas as outlined by the project objective: profitability, volume, risk (approximated by trade volume), and buy/sell patterns in relation to market sentiment.

Profitability vs. Sentiment

The analysis of profitability against market sentiment yielded some counter-intuitive results. The highest average profit and loss (PnL) was observed during periods of "Extreme Greed," not "Extreme Fear."

- **Extreme Greed**: The highest average PnL was recorded at approximately **$67.89**.
- **Fear**: The second-highest average PnL occurred during "Fear" with a value of **$54.29**.
- **Greed**: Average PnL stood at **$42.74**.
- **Extreme Fear**: Surprisingly, "Extreme Fear" periods had one of the lowest average PnLs at **$34.54**.
- **Neutral**: Neutral periods showed the lowest profitability, with an average PnL of **$34.31**.

This suggests that traders in this dataset were more profitable during optimistic or moderately fearful market conditions, rather than at the peak of fear.

Trade Volume vs. Sentiment

Trading volume, measured in USD, showed a different pattern compared to profitability.

- **Fear**: The highest average trading volume was seen during "Fear" periods, reaching approximately **$7,816**.
- **Greed**: "Greed" periods saw the second-highest volume at **$5,737**.
- **Extreme Fear**: The volume during "Extreme Fear" was **$5,350**.
- **Neutral**: Neutral markets had an average volume of **$4,783**.
- **Extreme Greed**: The lowest trading volume was observed during "Extreme Greed" at just **$3,112**.

This indicates that market uncertainty, particularly "Fear," drives higher trading activity, even if it doesn't correspond to the highest profitability.

Buy vs. Sell Patterns by Sentiment

The analysis of trade direction (buy vs. sell) across different sentiment classifications reveals distinct trader behaviours.

- During periods of **"Extreme Greed"**, **"Fear"**, and **"Greed"**, selling activity outpaced buying activity. The largest volume of both buy and sell trades occurred during **"Fear"**.
- Conversely, during **"Extreme Fear"** and **"Neutral"** periods, the number of buy trades was slightly higher than sell trades.

This pattern suggests a tendency for traders to take profits (sell) when the market is heated (Greed/Fear) and to accumulate (buy) when the market is either very fearful or indecisive.

Correlation: Sentiment Score vs. Profitability

To quantify the relationship between the raw sentiment score (where 0 is extreme fear and 100 is extreme greed) and profitability, a correlation was calculated.

- The correlation between the sentiment 'value' and 'Closed PnL' is **0.008121**.
- This extremely weak positive correlation suggests that there is almost no linear relationship between the daily sentiment score and the profitability of trades on that day. The line chart of Sentiment Score vs. Average Daily PnL also shows high volatility with no clear trend, reinforcing this lack of a strong, predictable relationship.

Actionable Insights & Trading Strategies

Based on this analysis, several strategic insights can be derived:

1. **Profit in Optimism**: Contrary to the common "buy the fear" adage, this dataset shows that the most profitable trades occurred during **"Extreme Greed"**. This could imply that for this specific market or set of traders, momentum-following strategies during bull runs are more effective than contrarian buying during downturns.

2. **Volume as a Signal of Volatility, Not Profit**: The highest trading volumes were observed during **"Fear"**, not during the most profitable periods. High volume in fearful markets might be a better indicator of high volatility and uncertainty rather than a direct signal for profitable entries.
3. **Sentiment-Based Directional Bias**: The data shows a clear pattern of **selling into greed/fear** and **buying during extreme fear/neutrality**. This could be a viable strategy:
    - **Consider taking profits or opening short positions** when market sentiment moves into "Greed" or "Fear" classifications.
    - **Look for buying opportunities** when the market enters "Extreme Fear," as this is when other traders in this dataset are accumulating.