

1. Assignment Overview

This assignment focuses on analyzing the relationship between **trader performance** and **market sentiment** in the cryptocurrency market.

The objective is to uncover hidden patterns between sentiment indicators and trading outcomes and to generate insights that can help in developing **smarter and more informed trading strategies**.

Two primary datasets were used for this analysis:

1. **Bitcoin Market Sentiment Dataset (Fear & Greed Index)**
2. **Historical Trader Data from Hyperliquid**

2. Data Acquisition and Preprocessing

2.1 Data Sources

- **Bitcoin Market Sentiment (Fear & Greed Index):**
Provides daily sentiment values and sentiment classifications such as Fear, Greed, Extreme Fear, etc.
- **Historical Trader Data (Hyperliquid):**
Contains detailed trade-level information including timestamps, trade side (BUY/SELL), trade size, and closed profit and loss (PnL).

These datasets together allow analysis of how market psychology influences trader behavior and profitability.

2.2 Preprocessing Steps

The following preprocessing steps were performed to prepare the data for analysis:

1. **Loading the Data**
Both datasets were loaded into pandas DataFrames for analysis.
2. **Initial Data Inspection**
 - .info() and .head() were used to understand data structure and data types
 - Missing values were checked using .isnull().sum()
 - No major missing data issues were found
3. **Date and Time Conversion**
 - The date column in the Fear & Greed dataset was converted to a datetime format
 - The timestamp columns in the trader dataset were also converted to datetime objects
 - This step was essential for time-based analysis and dataset merging
4. **Dataset Merging**
 - A trade_date column was extracted from the trader timestamps

- Both datasets were merged on the date column
- A **left join** was used to ensure that all trader records were retained

5. Saving Cleaned Data

- Cleaned and processed datasets were saved as CSV files for reuse:
 - Clean_fear_greed.csv
 - Cleaned_historical_data.csv
 - Complete_cleaned_data.csv

3. Exploratory Data Analysis (EDA)

3.1 Overview

Exploratory Data Analysis was performed to understand the distribution of key variables and identify early patterns.

This included statistical summaries and visual analysis of sentiment values, sentiment categories, and trading behavior.

3.2 Key Observations from EDA

1. Fear & Greed Index Distribution

- The Fear & Greed Index showed multiple peaks
- This indicates that certain sentiment levels occur more frequently than others
- Market sentiment is not evenly distributed over time

2. Sentiment Classification Distribution

- The most frequent sentiment category was **Fear**
- This was followed by **Greed**, **Extreme Greed**, **Neutral**, and **Extreme Fear**
- This suggests that periods of market concern are more common than extreme optimism

3. Trade Side Distribution

- BUY and SELL trades were relatively balanced
- A slightly higher number of SELL trades indicates active two-way participation in the market

4. Analysis of Trader Performance and Market Sentiment

4.1 Correlation Analysis

A correlation analysis was conducted between the **Fear & Greed Index value** and **Closed PnL**.

- **Correlation coefficient:** 0.01
- This indicates a **very weak positive relationship**

Sentiment Classification Total Closed PnL (USD)

Sentiment Classification	Total Closed PnL (USD)
Fear	3,357,155
Extreme Greed	2,715,171
Greed	2,150,129
Neutral	1,292,921
Extreme Fear	739,110

Key Insight:

- The highest total profits occurred during **Fear** periods
- **Extreme Fear** resulted in the lowest total profitability

This suggests that fearful market conditions may offer better trading opportunities when approached carefully.

4.3 Average Trade Size by Sentiment Classification

Fear	7,816.11
Greed	5,736.88
Extreme Fear	5,349.73
Neutral	4,782.73
Extreme Greed	3,112.25

Observation:

- Traders placed **larger trades during Fear periods**
- Trade sizes were smallest during Extreme Greed

This indicates stronger conviction or higher activity during fearful market conditions.

5. Visual Analysis

The following visualizations were created to support the analysis:

1. **Daily Average PnL by Sentiment Classification**
 - Shows fluctuations in average profitability across sentiment states
 - Certain sentiment periods show noticeable spikes in PnL
2. **Closed PnL Distribution by Sentiment Classification (Box Plot)**
 - Highlights the spread and outliers in profitability
 - Large profits and losses can occur under any sentiment condition
 - Reinforces the importance of individual strategy over sentiment alone

6. Insights and Trading Strategy Recommendations

1. Capitalize on Fear Periods

- Fear periods showed the highest total PnL and largest trade sizes
- Contrarian strategies may work well during these periods
- Traders can look for undervalued assets caused by temporary market panic
- Proper technical and fundamental analysis is essential to avoid false signals

2. Be Cautious During Extreme Fear and Extreme Greed

- Extreme Fear showed the lowest profitability and high volatility
- Reducing exposure during such periods can help preserve capital
- Extreme Greed may signal market tops and overconfidence
- Traders should avoid emotional decisions driven by FOMO

3. Focus on Risk Management

- Low correlation between sentiment and PnL highlights the importance of:
 - Stop-loss strategies
 - Position sizing
 - Capital protection
- A disciplined trading approach is more important than sentiment indicators alone

4. Use Sentiment as a Supporting Indicator

- Sentiment should act as a **confirmation tool**, not a standalone signal
- Combining sentiment with technical and fundamental analysis leads to better decisions

5. Adjust Trade Size Based on Sentiment

- Larger trade sizes during Fear suggest higher opportunity
- Smaller positions during Extreme Greed can help manage downside risk
- Dynamic position sizing can improve long-term performance

7. Conclusion

Market sentiment provides valuable insight into overall market psychology but has a **weak direct relationship** with individual trade profitability.

However, when combined with aggregated profit data and trade size analysis, clear patterns emerge.

Fear-driven markets appear to offer more profitable opportunities, while Extreme Fear and Extreme Greed require increased caution.

Ultimately, consistent trading success depends on **risk management, strategy discipline, and using sentiment as part of a broader analytical framework**, rather than relying on it alone.