

# Data Science Assignment Report – Web3 Trading Team

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**Notebook:** [Google Colab Link](#)

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## 1. Objective

The goal of this analysis is to explore how trading behavior — including profitability, risk, leverage, and trade volume — aligns with or diverges from overall market sentiment (Fear vs. Greed). By examining both the **Bitcoin Market Sentiment dataset** and **Historical Trader Data**, we identify behavioral and statistical patterns that could inform smarter trading strategies.

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## 2. Dataset Overview

- **Bitcoin Market Sentiment:** Contains daily sentiment classifications such as *Fear*, *Greed*, *Neutral*, and *Extreme Greed*.
  - **Historical Trader Data:** Includes detailed trading metrics such as execution price, size, leverage, and closedPnL.
  - Data merged on **Date** to align trading activity with prevailing sentiment.
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## 3. Key Findings

### Sentiment Distribution

- The market is dominated by **Fear (72.65%)**, followed by **Greed (19.69%)**, **Neutral (3.88%)**, and **Extreme Greed (3.78%)**.
  - The mean Fear & Greed Index is **51.62**, indicating moderately optimistic sentiment but with high variability.
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### Trading Behavior by Sentiment

- **Extreme Greed** is associated with the **highest mean trade size: \$5,660.27**.
  - **Fear** has the **largest total trade volume: \$704 million USD**, but a **lower mean trade size (\$5,259.98)** — suggesting higher participation with smaller positions.
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### Profitability (Fear vs. Greed)

- **Mean Closed PnL:** Greed = **\$87.89**, Fear = **\$50.05**.
  - **Volatility:** Fear periods show greater spread (**std = \$1,148.34**) and maximum PnL (**\$135,329.09**) than Greed (**\$44,223.45**).  
→ Traders face **higher risk and potential reward** during Fear phases.
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### Leverage and Risk

- **Extreme Greed** shows the **highest profitability rate (49.01%)**, yet also a high rate of **unprofitable trades (13.21%)**.
  - **Fear** sentiment leads to **fewer losses (6.69%)** but more **neutral trades (51.79%)**.  
→ Indicates cautious positioning and reduced risk appetite during Fear.
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### Trade Volume & Correlation

- **Correlation between Trade Volume and Sentiment: -0.572 (moderate negative)**.  
→ As market sentiment becomes greedier, **overall trading volume decreases** — suggesting selective participation during optimistic periods.
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### Hypothesis Testing

- A **t-test** comparing Fear vs. Greed PnL yields **p-value = 0.0000**, confirming a **statistically significant difference** in profitability between the two sentiment phases.
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### Cluster Analysis

Using **K-Means (k=4)**:

- **Cluster 0:** Greed/Extreme Greed – moderate trades, positive PnL.
  - **Clusters 1 & 3:** Fear – lower risk, smaller trade sizes.
  - **Cluster 2:** Mixed sentiment – high PnL, larger positions.  
→ Distinct behavioral clusters reflect traders' sentiment-driven decisions.
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## 4. Conclusion

This analysis highlights a **strong interplay between sentiment and trading behavior**:

- **Fear** dominates the market and correlates with **higher trading activity but lower average profitability**.
- **Greed** phases produce **fewer but more profitable trades**.
- **Extreme Greed** triggers both the **best and worst outcomes**, marking periods of **high volatility and risk**.

These findings can help design **sentiment-aware trading strategies**, such as adjusting leverage or position size based on market mood.

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