Data Science Assignment

1. Introduction

The purpose of this analysis will be to understand the relationship between trading performances and the sentiment of the market (Fear & Greed Index), and to gain insights on trading patterns and behavior to develop a smarter trading decision-making system, informed by this sentiment data.

The study combines:

1.Transaction data from historical data

2.Bitcoin Fear & Greed Index data

By merging these two datasets together, the study examines the differences of profitability risks, trading activities, and behavioral patterns under various levels of market sentiment.

2. Data Overview

2.1 Datasets Used

1. Historical_Data.csv

- Account
- Coin
- Execution Price
- Size tokens
- Size USD
- Side
- Timestamp (IST)
- Start Position
- Direction
- Transcation hash
- Order ID
- Crossed
- Fee
- Trade ID
- Closed PnL
- Timestamp

2. Fear & Greed Index

- Timestamp
- Value
- Classification (Fear / Greed)

- Date

The datasets were merged on the trade date to align individual trading activity with the corresponding market sentiment.

3. Methodology

1.Cleaned and standardized column names for consistency

2.Converted timestamps to a common date format

3.Merged trader data with sentiment data using date alignment

4.Performed comparative analysis across sentiment regimes

5.Used trade size and transaction fees as risk proxies (explicit leverage data was unavailable)

6.Generated visualizations to support findings

4. Key Findings

4.1 Profitability vs Market Sentiment

- Greed periods show higher average trader profitability, but also significantly higher variance.
- Fear periods exhibit lower average profits, but losses are relatively more controlled.

Insight:
Greed-driven markets amplify outcomes due to aggressive positioning, whereas fear-driven markets encourage cautious trading behavior.

4.2 Risk Exposure Patterns: Trade Size and Transaction Fees

Transaction fees were analyzed as a proxy for risk exposure and trading intensity, as higher fees typically result from larger position sizes and more aggressive trading behavior.

Observation:

- Average transaction fees are higher during Greed periods compared to Fear periods.
- Fear phases show lower and more consistent fee exposure, reflecting reduced trade sizes and cautious participation.

Insight:
Elevated fee exposure during Greed indicates increased trading aggressiveness and higher capital deployment, which amplifies both potential returns and downside risk. In contrast, Fear-driven markets exhibit controlled fee exposure, suggesting disciplined risk management.

4.3 Trading Volume Dynamics

- Total trading volume is substantially higher during Greed phases.
- Volume contracts during Fear phases, indicating reduced participation and capital deployment.

Insight:
Liquidity and participation are sentiment-sensitive, with Greed attracting more active trading behavior.

4.4 Behavioral Bias: Buy vs Sell Activity

- Buy-side dominance increases during Greed periods.
- Fear periods show more balanced or defensive positioning between buy and sell trades.

Insight:
Trader behavior becomes momentum-driven during Greed and more defensive during Fear.

4.5 Volatility and Risk-Adjusted Performance

- Profit volatility (PnL standard deviation) is higher during Greed.
- Risk-adjusted returns (PnL relative to trade size) differ across sentiment regimes, indicating that higher profits during Greed do not always translate to superior efficiency.

Insight:
Higher returns during Greed come with disproportionate risk, while Fear phases may offer more stable risk-adjusted outcomes.

5. Strategic Insights & Signals

Based on the analysis, the following sentiment-aware insights emerge:

Risk Management:
Reduce position sizes and overall risk exposure during Greed phases to control elevated volatility and downside risk.

Stability Focus:
Fear-driven markets tend to favor conservative or defensive strategies with improved downside protection and stability.

Sentiment-Aware Allocation:
Adjust trading aggressiveness dynamically based on prevailing market sentiment rather than applying static strategy parameters.

Behavioral Awareness:
Buy-side crowding during Greed periods can signal momentum-driven behavior and increased late-entry risk.

Volatility Control:
Higher profit volatility during Greed suggests the need for tighter risk limits and stricter exit conditions.

Fee Sensitivity:
Rising transaction fees during Greed can erode net returns, indicating the importance of execution efficiency and trade frequency control.

Liquidity Timing:
Increased trading volume during Greed supports liquidity-seeking strategies, while Fear periods may require selective, high-conviction trades.

Risk-Adjusted Focus:
Superior raw profits during Greed do not always translate into better risk-adjusted returns, emphasizing efficiency over absolute gains.

6. Limitations

- Explicit leverage data was not available; trade size and fees were used as risk proxies.
- Analysis was limited to Fear and Greed classifications without extreme sentiment sub-categories.
- Trader-level longitudinal performance was not explored in this assignment scope.

6. Conclusion

This analysis demonstrates a clear relationship between market sentiment and trader behavior. Fear and Greed regimes influence profitability, risk exposure, trading volume, and behavioral patterns in distinct ways. Greed-driven markets are associated with higher potential returns but increased volatility, risk-taking, and transaction costs, while Fear-driven markets exhibit more cautious behavior and improved downside control.

The findings highlight the importance of incorporating market sentiment as a contextual factor in trading decisions. By adopting sentiment-aware risk management and strategy adjustments, traders can better align their behavior with prevailing market conditions and improve performance consistency. Overall, the results confirm that market sentiment plays a meaningful role in shaping trading outcomes and can serve as a valuable input for smarter trading strategies.