Sentiment-Driven Trading Behavior Analysis

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1. Objective

This project explores how market sentiment—captured by the Fear & Greed Index—affects trader behavior and performance. By merging sentiment data with historical trade records, we aim to uncover patterns that can inform smarter trading strategies and risk management.

2. Data Overview

- **Fear & Greed Index:**
  - 2,644 daily records
  - Sentiment classifications: Extreme Fear, Fear, Neutral, Greed, Extreme Greed
  - Format: Epoch timestamp, sentiment value, classification, date
- **Historical Trade Data:**
  - 211,224 trades
  - Features: Execution price, trade volume, fee, PnL, side (BUY/SELL), timestamp
  - Time range: 480 unique trading days

3. Methodology

- **Timestamp Alignment:** Converted both datasets to `datetime64[ns]` format and extracted trade dates for merging.
- **Data Merge:** Merged on trade date using a left join, resulting in sentiment labels for each trade. Only 6 unmatched rows were dropped.
- **Feature Analysis:** Grouped trades by sentiment and analyzed metrics like `Closed PnL`, `Fee`, `Size USD`, and `Side`.
- **Correlation Matrix:** Computed Pearson correlations between numeric features to identify interdependencies.

4. Key Insights

Profitability by Sentiment

Sentiment	Avg Closed PnL
Extreme Greed	67.89
Fear	54.29
Greed	42.74
Extreme Fear	34.53
Neutral	34.30

Extreme Greed yields the highest profit with lowest volume and fee—suggesting strategic, selective trading.

- **Fear** drives high volume and cost, yet remains profitable—possibly due to panic-driven opportunities.

Volume and Fee Behavior

Sentiment	Avg Volume	Avg Closed PnL
Fear	7816.11	1.50
Greed	5736.88	1.25
Extreme Fear	5349.73	1.12
Neutral	4782.73	1.04
Extreme Greed	3112.25	0.68

Fear leads to larger trades and higher fees—traders may be reacting emotionally or chasing volatility.

- **Extreme Greed** shows the most efficient behavior—low cost, low volume, high profit.

Buy vs Sell Behavior

Sentiment	% BUY	% SELL
Extreme Fear	51.1%	48.9%
Extreme Greed	44.9%	55.1%
Fear	48.9%	51.0%
Greed	48.8%	51.1%
Neutral	50.3%	49.7%

Extreme Fear triggers contrarian optimism—more buying, possibly expecting a rebound.

- **Extreme Greed** triggers caution—more selling, likely profit-taking before a correction.

Correlation Matrix

Feature Pair	Correlation
Fee <> Size USD	0.75
Closed Pnl <> Size USD	0.12
Fee <> Execution Price	0.23
Closed Pnl <> Fee	0.08

- Strong correlation between **fee and volume** confirms volume-based cost structure.
- Weak correlation between **PnL and other features** suggests profit depends more on strategy than size or cost.

5. Conclusion

Market sentiment significantly influences trading behavior—not just in volume and cost, but in positioning and profitability.

- **Extreme Greed** is the most efficient state for traders.
- **Fear** drives high engagement and cost, but can still be profitable.
- **Neutral sentiment** leads to minimal activity and balanced behavior.

These insights can inform trading strategies, risk models, and sentiment-aware decision-making in real-world platforms.

6. Appendix

Include the following visuals in your `outputs/` folder:

- `pnl_vs_sentiment.png`
- `volume_vs_sentiment.png`
- `fee_vs_sentiment.png`
- `buy_sell_distribution.png`
- `correlation_matrix.png`