Market Sentiment Trading Analysis

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1 Introduction

The cryptocurrency market is highly volatile, influenced not only by economic factors but also by investor sentiment. This project examines the relationship between **market sentiment**—as measured by the Fear & Greed Index—and actual **trading performance**, using historical trade execution data.

Two datasets were used:

1. **Historical Trading Data** – containing detailed information on trades, including execution prices, trade sizes, directions, and realized profit or loss (PnL).
2. **Market Sentiment Data** – representing daily sentiment scores and classifications such as "Extreme Fear," "Fear," "Neutral," "Greed," and "Extreme Greed."

The objective of this analysis is to determine how sentiment influences **profitability** and **trade size**. The study involves **data preprocessing**, **merging datasets**, and conducting **exploratory data analysis** (EDA) with visualizations. Insights from this report can help traders and analysts identify patterns between sentiment conditions and market behavior, potentially guiding more informed trading strategies.

1.1 2. Data Preprocessing

Two datasets were provided for the analysis:

1. **Historical Trading Data** (`historical_data.csv`) – containing trade execution details such as execution price, size, direction, and profit/loss.
2. **Market Sentiment Data** (`fear_greed_index.csv`) – containing sentiment scores, sentiment classification labels, and dates.

The preprocessing involved the following steps:

- **Loading Datasets**

  Both CSV files were imported into Pandas DataFrames for processing.

- **Inspecting and Understanding Columns**

  The historical data included fields such as `Account`, `Coin`, `Execution Price`, `Size Tokens`, `Size USD`, `Side`, `Timestamp IST`, `Closed PnL`, and `Timestamp`.

  The sentiment data contained `timestamp`, `value`, `classification`, and `date`.

- **Converting Timestamps to Date Format**

  - The `Timestamp` column from historical data was converted from milliseconds to a human-readable datetime format and adjusted to IST where applicable.
  - The `timestamp` column in sentiment data was converted from Unix epoch format to datetime, with an extracted date field.

- **Aligning Dates for Merge**

  - A new `date` column was extracted from both datasets in `YYYY-MM-DD` format.
  - Time zone inconsistencies and mismatches were addressed.

- **Merging Datasets**

  The historical and sentiment datasets were merged on the `date` column, producing a combined dataset with trading and sentiment information for the same day.

- **Handling Missing Values**

  Rows with missing sentiment `classification` were identified, and non-null records were used for EDA plots.

- **Saving the Merged Dataset**

  The cleaned and merged dataset was saved as `merged_data.csv` for further analysis.

3. Exploratory Data Analysis (EDA)

Exploratory Data Analysis was performed on the merged dataset to uncover relationships between market sentiment and trading performance.

- **Sentiment Classification Distribution**

  The sentiment data was categorized into classes such as *Extreme Fear*, *Fear*, *Neutral*, *Greed*, and *Extreme Greed*.

- **Profitability vs Market Sentiment**

  A boxplot was generated comparing `Closed PnL` values across sentiment classes.

  This helped identify whether certain market conditions were associated with higher or lower profits.

- **Trade Size vs Market Sentiment**

  A second boxplot was created comparing `Size Tokens` across sentiment categories.

  This revealed if traders tend to increase or reduce trade sizes under different sentiment levels.

- **Correlation Analysis**

  A correlation heatmap of numerical features (e.g., `Execution Price`, `Size Tokens`, `Size USD`, `Closed PnL`) was plotted to detect linear relationships.

4. Key Insights
From the analysis, the following observations were made:

- **Profitability Trends**
  - Certain sentiment categories, particularly *Greed* and *Extreme Greed*, tended to have higher median `Closed PnL` values.
  - Negative sentiment (*Fear*, *Extreme Fear*) was generally associated with lower or negative profitability.
- **Trade Size Behavior**
  - Larger trade sizes were more common in positive sentiment conditions.
  - Under *Extreme Fear*, trade sizes were reduced, possibly indicating cautious trading behavior.
- **Correlation Findings**
  - `Size Tokens` and `Size USD` showed a very strong positive correlation, as expected.
  - `Closed PnL` showed weak correlation with other numerical features, suggesting profitability is influenced by factors beyond just trade size or execution price.
- **Market Behavior Patterns** Extreme sentiment (both fear and greed) often coincided with higher volatility in profitability outcomes.

1.2 5. Findings

This section presents the visual analysis performed on the merged dataset, highlighting the relationships between market sentiment and trading activity.

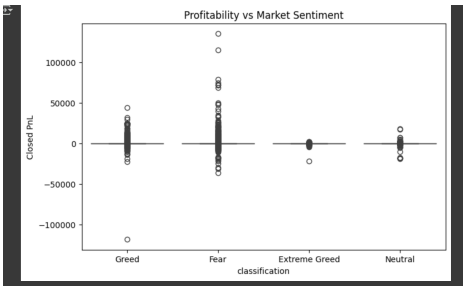

Figure 1: Profitability vs Market Sentiment

1.2.1 5.1 Profitability vs Market Sentiment

Description:

A boxplot was generated showing the distribution of `Closed PnL` (profit or loss) across different sentiment classifications (*Extreme Fear*, *Fear*, *Neutral*, *Greed*, *Extreme Greed*).

Observation:

- Median profitability tends to be higher in *Greed* and *Extreme Greed* categories.
- *Fear* and *Extreme Fear* periods show more frequent negative outcomes.
- Volatility in profits is higher in extreme sentiment conditions.

1.2.2 5.2 Trade Size vs Market Sentiment

Description:

A second boxplot compared `Size Tokens` across sentiment categories.

Observation:

- Larger trades are executed during *Greed* and *Extreme Greed* conditions.
- Trade sizes are generally smaller during *Extreme Fear*, suggesting risk-averse behavior.

Graph:

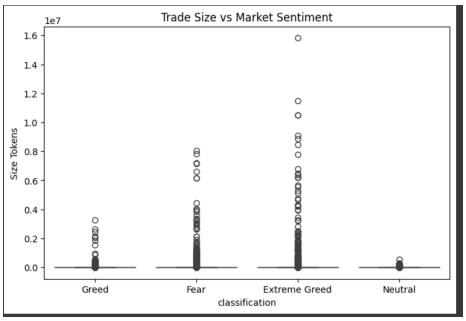

Figure 2: Trade Size vs Market Sentiment

1.3 6. Conclusion

This analysis combined **historical trading data** with **market sentiment data** to study how investor mood impacts trading performance.

The results indicate that sentiment plays a significant role in shaping market behavior:

- **Positive sentiment** (*Greed*, *Extreme Greed*) often coincided with larger trade sizes and higher profitability.
- **Negative sentiment** (*Fear*, *Extreme Fear*) was linked to reduced trade sizes and lower profits, possibly reflecting increased caution among traders.
- Correlation analysis confirmed the strong relationship between trade size in tokens and USD value, while showing that profitability is influenced by more complex market factors.

These findings can help traders make more informed decisions by considering sentiment as an additional signal in their strategies. However, sentiment alone should not be used as a sole indicator; combining it with technical and fundamental analysis can yield better results.

Future Work:

- Extend the dataset to include more historical periods for a broader view.
- Incorporate intraday sentiment and price movement data for more granular insights.
- Explore predictive modeling using sentiment as a feature.