Primetrade.ai Data Science Assignment

Trader Behavior and Market Sentiment Analysis

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1. Objective

The goal of this assignment is to analyze how trading behavior (profitability, risk, volume, leverage) aligns or diverges from overall market sentiment (Fear vs Greed).

The aim is to identify hidden patterns or relationships that could guide smarter trading strategies in crypto markets.

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2. Data Overview

a. Bitcoin Market Sentiment Dataset

- Columns: timestamp, value, date, classification
- Description: Contains daily Fear & Greed Index values indicating overall market sentiment.
- Cleaning Steps:
    - Converted timestamps to human-readable datetime.
    - Checked for missing or duplicate entries.
    - Confirmed data consistency across all rows.

Insights:

- No missing or duplicate values were found.
- Sentiment classifications ranged from Extreme Fear to Extreme Greed.
- The dataset covered over 2600 days of data.

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b. Trader Dataset (Hyperliquid Platform)

- Columns: Account, Coin, Execution Price, Size Tokens, Size USD, Side, ClosedPnL, Fee, Timestamp, etc.
- Description: Captures detailed information of individual trades including profitability, trade direction, and position size.
- Cleaning Steps:
    - Converted timestamps into IST datetime format.
    - Standardized data types and ensured all numeric values were clean.
    - Verified for duplicates and missing entries.

Insights:

- Trader data captured multiple coins and accounts.
- Columns like ClosedPnL and Fee were key in constructing new metrics.

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3. Data Merging and Feature Engineering

Both datasets were merged on the Date column to align trader activity with the prevailing market sentiment.

New Metrics Created

Metric	Formula	Description
Net_PnL	ClosedPnL - Fee	Actual profit/loss after accounting for fees.
NetPnl%	(Net_PnL / SizeUSD) * 100	Percentage return per trade.
Win/Loss Flag	Based on sign of Net_PnL	Indicates profitable or losing trade.

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4. Sentiment-wise Analysis

After merging, the data was grouped by sentiment classification to explore performance patterns.

Key Metrics

- Average Net PnL
- Average Net PnL%
- Win Rate (%)

Visualizations

1. Average Net PnL under Fear vs Greed
2. Win Rate (%) Comparison
3. Distribution of Net PnL
4. Average Net PnL% Comparison

(See image: outputs/SentimentWiseAnalysis.png)

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5. Insights & Interpretation

a. Profitability Trends

- Greed phases showed slightly higher average Net PnL, indicating traders take advantage of upward momentum.
- However, increased volatility in these phases also led to higher losses for riskier trades.

b. Win Rate

- Fear phases exhibited a more consistent win rate, suggesting conservative trades perform more reliably under negative sentiment.

c. Risk and Return Profile

- The distribution of Net PnL was wider during Greed, meaning higher variability — both higher gains and larger losses.
- Fear periods displayed tighter, more stable distributions — indicating risk-averse trading behavior.

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6. Summary Table

Sentiment	Avg Net PnL	Avg Net PnL%	Win Rate (%)	Interpretation
Fear	Lower	Moderate	Higher	Stable, less risky
Greed	Higher	Higher	Slightly lower	Volatile, higher reward but riskier

7. Conclusion

- Market sentiment plays a clear role in trader behavior and profitability.
- Greed phases attract aggressive trading and higher potential gains but with amplified risks.
- Fear periods foster conservative strategies with more consistent, lower-volatility performance.
- For algorithmic or strategy-based trading, sentiment-driven adjustments could enhance performance consistency.