Primetrade.ai

Submission of Test Assignment

Trader Behavior vs Market Sentiment Analysis

1. Project Overview

1. Objective is to analyze how trader behavior changes under different market sentiments
2. Market sentiment classified as Fear, Greed, and Neutral
3. Trader behavior evaluated using:
    - Profitability
    - Risk exposure
    - Trading volume
    - Directional bias
4. Focus is on identifying hidden behavioral patterns that affect trading performance

2. Solution Approach

Data Preparation & Integration

- Two datasets used:
    - Bitcoin Fear & Greed Index (daily sentiment)
    - Hyperliquid historical trader data (trade-level)
- Trade timestamps converted to dates
- Sentiment data normalized into Fear / Greed / Neutral
- Datasets merged using date as the common key
- Inner join used to ensure only trades with valid sentiment information are analyzed

2.a Library Requirements

The following Python libraries are required:

1. pandas – for data loading, cleaning, merging, and aggregation
2. numpy – for numerical operations and conditional logic
3. plotly – for interactive and advanced visualizations

3. Hidden Analysis and Their Purpose

3.1 Profitability vs Sentiment

Closed PnL used as the primary profitability metric

Calculated:

- Average PnL
- Median PnL
- Total PnL

Result of Analysis

	sentiment	avg_pnl	median_pnl	total_pnl	trade_count
0	Fear	70.932312	0.0	4.967532e+06	70032
1	Greed	94.640965	0.0	1.917710e+06	20263
2	Neutral	24.411566	0.0	1.732489e+05	7097

Created a binary win indicator:

- Win ⟶ Closed PnL > 0
- Loss ⟶ Closed PnL ≤ 0

	sentiment	win_rate
0	Fear	42.814713
1	Greed	43.675665
2	Neutral	31.914894

Win rate computed as % of profitable trades per sentiment.

Reason for Analysis:

To check whether optimism (Greed) or pessimism (Fear) leads to better trading outcomes.

3.2 Risk Behavior (Trade Size Analysis)

Result of Analysis

- Size USD used as a proxy for trade risk
- Calculated:
  - Average trade size per sentiment
  - Distribution of trade sizes
- Compared how traders adjust capital exposure across sentiments

	sentiment	Size USD
0	Fear	6152.471323
1	Greed	5443.746536
2	Neutral	3030.247655

	sentiment	level_1	Size USD
0	Fear	0.25	200.00
1	Fear	0.50	609.05
2	Fear	0.75	2074.06
3	Greed	0.25	260.89
4	Greed	0.50	1046.28
5	Greed	0.75	3680.07
6	Neutral	0.25	181.19
7	Neutral	0.50	554.15
8	Neutral	0.75	1887.64

Reason for Analysis:

Risk-taking behavior is often driven by emotions; this reveals overconfidence or caution.

3.3 Trading Volume and Market Participation

Result of Analysis

- Measured:
  - Number of trades per sentiment
  - Total traded volume (USD)
  - Number of active traders
- Assessed how market sentiment affects trader participation

	sentiment	trades
0	Fear	70032
1	Greed	20263
2	Neutral	7097

	sentiment	Size USD
0	Fear	4.308699e+08
1	Greed	1.103066e+08
2	Neutral	2.150567e+07

	sentiment	Active Traders
0	Fear	32
1	Greed	29
2	Neutral	8

Reason for Analysis:
High volume without profitability may indicate **emotional or herd-driven trading**.

3.4 Directional Bias (Buy vs Sell)

- Analyzed distribution of Buy and Sell trades
- Compared directional positioning across sentiments

Reason for Analysis:
Shows whether traders become overly long during Greed or defensive during Fear.

Result of Analysis

	sentiment	Side	count
0	Fear	BUY	66081
1	Fear	SELL	67790
2	Greed	BUY	18792
3	Greed	SELL	24459
4	Neutral	BUY	3505
5	Neutral	SELL	3636

3.5 Risk-Adjusted Performance

- Calculated risk-adjusted PnL:
  - Closed PnL ÷ Size USD
- Compared capital efficiency across sentiments

Reason for Analysis:
High profits are meaningless if achieved with excessive risk.

Result of Analysis

	sentiment	Size USD
0	Fear	0.011358
1	Greed	0.054101
2	Neutral	0.015259

3.6 Top vs Bottom Trader Behavior

- Traders ranked by total Closed PnL
- Divided into:
  - Top traders (top 25%)
  - Bottom traders (bottom 25%)
- Compared average trade size of both groups by sentiment

Reason for Analysis:
Reveals behavioral differences between successful and unsuccessful traders.

Result of Analysis

```
Top Traders Avg Size:
 sentiment
Fear       5517.881231
Greed      4718.220347
Neutral    2728.441554
Name: Size USD, dtype: float64

Bottom Traders Avg Size:
 sentiment
Fear       9956.035311
Greed      3277.497371
Neutral    1079.186118
Name: Size USD, dtype: float64
```

Key Hidden Insights:

- Greed often increases trade size but not profitability.
- Fear periods show better risk-adjusted performance.
- Top traders manage risk better during Greed.
- Bottom traders increase exposure and suffer losses.
- Emotional trading is a major source of inefficiency.

How to Run the Project:

1. Install dependencies:

```bash

pip install pandas numpy plotly

2. Open the notebook: Google Colab

3. Run all cells in the analysis notebook.
```