Data Science Assignment Report

Title: Analysing the Relationship Between Trader Behaviour and Market Sentiment
Name: Anuj Yadav

📚 Introduction

This assignment explores the relationship between trader behaviour and market sentiment using two key datasets:

- A historical dataset of cryptocurrency trader activity (from Hyper liquid)
- The Bitcoin Fear & Greed Index (FGIndex)

The objective is to understand how profitability, risk, volume, and trading patterns align or diverge with public market sentiment categorized as Fear, Greed, or Extreme Fear.

📊 Dataset Overview

🔹 Trader Data

- Contains detailed trade logs: account, execution price, size, start position, closed PnL, timestamp, etc.
- Covers years: 2023 to 2025

🔹 Sentiment Data (FGIndex)

- Contains daily market sentiment classification like Fear, Greed, Extreme Fear, etc.
- Covers time range: 2018 to 2025
- Key columns: date, value, classification

ℹ️ Preprocessing & Cleaning

✅ Is it necessary to extract date (without time) from 'Timestamp IST' column?

Yes, and here's why:

Why it's necessary:

1. To merge with the sentiment dataset
    - FGIndex has dates like 2024-01-01 → Classification: Fear
    - Historical data has 2024-01-01 14:35:22
    - Direct joins would fail without date alignment
2. Sentiment is daily
    - We want to tag every trade with daily sentiment
    - Not hour/minute-level sentiment

If we don't extract the date:

- Merge will fail (no matching keys)
- We might get an empty merged dataset or incorrect sentiment tagging

❌ Why we shouldn't fill missing dates with Na or 0

- Date is essential for matching sentiment
- Fake/missing dates corrupt analysis
- We dropped 131,999 rows without valid date values to ensure accuracy

📊 Why rename classification to Sentiment?

- Original name: classification is too generic
- New name: Sentiment clearly reflects what the column represents
- Helps in plot titles, axes, and groupings

❌ Sentiment Date Coverage Mismatch

- Trader Data has records until: 2025-12-04
- FGIndex stops at: 2025-05-02
- Hence, 43,361 trades have NaN Sentiment values post-May 2025
- These trades were either excluded or flagged for limitation

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📈 **Analysis & Visualizations**

Created and saved 10 visualizations, each uncovering a specific angle:

Chart	Description
sentiment_pie_chart.png	Sentiment distribution
buy_sell_percent_by_sentiment.png	% of BUY/SELL per sentiment
profit_vs_loss_pie.png	% of traders in profit vs loss
Average_Profit_Loss_by_Sentiment.png	Avg. profit/loss per sentiment
Average_Start_Position_by_Sentiment.png	Avg. start position by sentiment

Chart	Description
trade_volume_trend_by_sentiment.png	Daily volume trend by sentiment
Total_Trade_Volume_USD_by_sentiment.png	Total trade volume (USD)
start_position_by_sentiment_side.png	Boxplot: start position by side
scatter_volume_vs_pnl.png	Profit vs volume by sentiment
daily_avg_pnl_by_sentiment.png	Daily avg. PnL by sentiment

🔍 5. Key Insights

🧠 1. Most Trades Happen During Fear

- ~38% of trades occur during Fear.
- Indicates fear triggers market activity.

🛒 2. Buy-Side Dominance in Fear

- Most trades in Fear/Extreme Fear are BUY.
- Suggests dip-buying strategy during emotional markets.

💰 3. 87.5% of Traders are in Profit

- Only 12.5% are in Loss.
- Profitable traders participated in all sentiments, especially Fear and Greed.

📉 4. Losses Cluster in Extreme Sentiments

- More losses during Extreme Greed and Extreme Fear.
- Stable sentiments (e.g., Neutral) had fewer losses.

📊 5. Fear Drives Trade Volume

- Line plot shows trade volumes spiking during Fear.
- Traders act aggressively when the market is scared.

⚠️ 6. Riskier Behavior in Extreme Sentiments

- Wider variance in Start Position and PnL in these periods.
- Higher leverage and volatility likely.

📝 6. Conclusion

This analysis reveals that:

- Market sentiment clearly influences trading behaviour.
- Traders tend to act most aggressively during Fear.
- Profitability is still achievable during all sentiments but requires disciplined strategy.
- Extreme sentiments introduce higher risk and reward potential.
- Neutral sentiment zones see steadier, more predictable outcomes.

By aligning trading strategies with sentiment patterns, traders can:

- Better time their entries and exits
- Assess risk more effectively
- Avoid overexposure during emotional (extreme) market phases

This assignment demonstrates how combining behavioural market data with public sentiment metrics enables smarter, more informed trading strategies.