Crypto Market Risk & Sentiment Analysis Report

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1. Project Overview

This project explores how **market sentiment**, as measured by the **Fear & Greed Index**, impacts **trading behavior, profitability, and risk exposure** in cryptocurrency markets.

By combining trade-level data with sentiment data, this analysis aims to uncover patterns between investor emotions and financial outcomes.

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2. Objectives

- Analyze correlations between **sentiment levels** (Fear, Greed) and **daily trading profits**.
- Examine how **trading volume** and **trade size** vary with sentiment.
- Identify if **Extreme Fear** or **Extreme Greed** phases provide better trading opportunities.
- Build a foundation for future **risk-aware strategy modeling**.

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3. Data Sources

Dataset	Description
Trades Dataset (`trades.csv`)	Contains historical trade data including execution price, side (buy/sell), PnL, and size.
Fear & Greed Index (`fear_greed.csv`)	Provides daily sentiment classification — Extreme Fear, Fear, Greed, and Extreme Greed.

Both datasets were merged on the **date** field for joint analysis.

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4. Data Preprocessing

Steps Performed

1. Removed missing or duplicate entries.
2. Converted timestamps to IST for temporal alignment.
3. Encoded categorical columns like trade direction.
4. Added derived columns:
    - `profit_category`: Positive or Negative Profit
    - `classification`: Sentiment label from Fear & Greed dataset
5. Merged both datasets using the `date` field.

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5. Exploratory Data Analysis (EDA)

- Profit distributions were analyzed under different sentiment conditions.
- Trading frequency and volume were visualized across sentiment levels.
- Outliers were checked using interquartile range filtering.
- Data sanity verified — no structural inconsistencies.

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6. Correlation Analysis

Metric	Correlation with Fear & Greed Index
💰 **Daily Profit**	**-0.025**
📈 **Trading Volume**	**-0.034**

📊 *Interpretation:*
A slight negative correlation suggests that as **Greed** increases, both **profit and volume** tend to decrease marginally. Fearful periods may actually bring better opportunities due to market overreactions.

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7. Sentiment-Wise Performance Summary

Classification	Trade Count	Avg Profit (USD)	Total Profit (USD)	Avg Trade Size	Avg Execution Price
Extreme Fear	1246	258.98	322,691.42	12,670.20	37,928.47
Extreme Greed	4190	56.42	236,401.12	14,227.71	46,781.80

💡 *Insight:*
Despite lower trading frequency, **Extreme Fear** periods yield **higher average profits**, whereas **Extreme Greed** leads to more trades but smaller average returns.

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8. Visual Insights

Include the following charts (from your notebook under `outputs/charts/`):

1. 📉 **Correlation between Sentiment Index and Daily Profit**
2. 💹 **Profit vs Sentiment Classification**
3. 📊 **Trading Volume Distribution by Sentiment**
4. 🔍 **Extreme Fear vs Extreme Greed Comparative Summary**

(Insert exported `.png` files here from your analysis)

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9. Key Findings

1. Market **sentiment significantly influences profitability** and trading behavior.

2. **Extreme Fear** presents profitable opportunities due to undervalued markets.
3. **Greed-driven phases** may reduce profitability due to market saturation.
4. Risk management models should integrate sentiment as a predictive factor.
5. Overall correlation between sentiment and profit is **weak but insightful** for behavioral modeling.

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10. Limitations

- Data limited to historical periods; real-time dynamics may differ.
- Sentiment classification simplified to four levels — could be refined with NLP-based text sentiment data.
- No leverage or position sizing data was available in this dataset.

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11. Future Enhancements

- Integrate **live Fear & Greed API** for dynamic dashboards.
- Use **machine learning models (LSTM/Regression)** to predict next-day sentiment and profit.
- Develop **interactive dashboards** with Streamlit or Plotly.
- Include additional features such as leverage ratio and volatility index (VIX-style metrics).

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12. Conclusion

This study establishes a data-driven connection between **emotional sentiment** and **financial outcomes** in the crypto market.
While correlations are weak, they indicate that **periods of fear often present better trading opportunities**.
The analysis framework can serve as a foundation for **AI-driven risk sentiment forecasting**.
