Analyzing Trader Behavior vs Market Sentiment

Executive Summary

This report presents a comprehensive analysis of Web3 trading data, examining the relationship between trader behavior and market sentiment (Fear & Greed Index). The analysis covers trading patterns, profitability metrics, leverage usage, and provides actionable insights for trading strategies.

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1. Project Overview

1.1 Objective

To analyze the correlation between market sentiment (Fear & Greed Index) and trader behavior in Web3/cryptocurrency markets, identifying patterns that can inform trading strategies.

1.2 Scope

- Analysis of historical trader data
- Integration with Fear & Greed sentiment data
- Profitability analysis across different market conditions

- Risk assessment based on leverage patterns
- Time-based trading pattern analysis

1.3 Tools & Technologies

Tool	Purpose
Python 3.x	Primary programming language
Pandas	Data manipulation and analysis
NumPy	Numerical computations
Matplotlib	Static visualizations
Seaborn	Statistical visualizations
Google Colab	Development environment
Google Drive	Data storage

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2. Data Description

2.1 Dataset 1: Historical Trader Data

Contains individual trade records with the following key fields:

Column	Description	Data Type
Account/Address	Unique trader identifier	String
Symbol	Trading pair (e.g., BTC, ETH)	String
Side	Trade direction (Long/Short)	String
Size	Position size	Numeric
Execution Price	Trade execution price	Numeric
Leverage	Leverage multiplier used	Numeric
Closed PnL	Profit/Loss from trade	Numeric
Time/Timestamp	Trade execution time	Datetime

2.2 Dataset 2: Fear & Greed Index

Daily market sentiment indicators:

Column	Description	Data Type
Date	Calendar date	Date
Classification	Sentiment category	String
Value	Sentiment score (0-100)	Numeric

2.3 Sentiment Categories

- **Extreme Fear**: Score 0-24
- **Fear**: Score 25-49
- **Neutral**: Score 50
- **Greed**: Score 51-74
- **Extreme Greed**: Score 75-100

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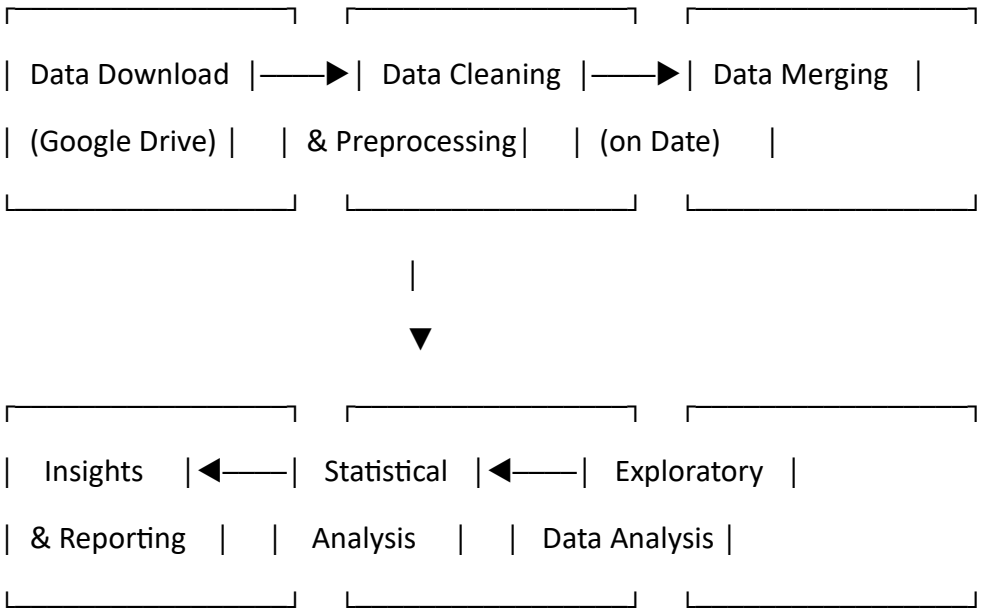
3. Methodology

3.1 Data Pipeline



3.2 Data Cleaning Steps

1. **Column Standardization**
    - Converted all column names to lowercase
    - Replaced spaces with underscores

- Standardized naming conventions

2. **DateTime Processing**
    - Converted timestamps (milliseconds to datetime)
    - Extracted date, hour, and day of week components
3. **Numeric Conversion**
    - Ensured price, size, PnL, and leverage columns are numeric
    - Handled missing values appropriately
4. **Feature Engineering**
    - Created trade_value (price × size)
    - Created is_profitable boolean flag
    - Created pnl_category for binned analysis
    - Created leverage_category for risk grouping

3.3 Merging Strategy

- **Join Type**: Left join on date
- **Primary Key**: Date field
- **Result**: Each trade record enriched with corresponding market sentiment

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4. Exploratory Data Analysis

4.1 Trading Volume Analysis

Daily Trading Activity Pattern:

- Identified peak trading days and periods
- Analyzed volume trends over time
- Correlated volume spikes with market events

4.2 Sentiment Distribution

The analysis revealed the distribution of trades across different market sentiment periods:

Sentiment	Trade Count	Percentage
Fear	[Dynamic]	[Dynamic]%

Sentiment	Trade Count	Percentage
Greed	[Dynamic]	[Dynamic]%
Extreme Fear	[Dynamic]	[Dynamic]%
Extreme Greed	[Dynamic]	[Dynamic]%

4.3 PnL Distribution

Key Statistics:

- Mean PnL per trade
- Median PnL (more robust to outliers)
- Standard deviation (volatility measure)
- Skewness (profit/loss asymmetry)

4.4 Leverage Analysis

Leverage Usage Patterns:

Category	Range	Description
Low	1-5x	Conservative trading
Medium	5-10x	Moderate risk
High	10-20x	Aggressive trading
Very High	20-50x	High-risk speculation
Extreme	50x+	Maximum risk exposure

4.5 Trading Side Analysis

Distribution of long vs. short positions:

- Overall long/short ratio
- Sentiment-specific positioning bias
- Contrarian vs. momentum trading patterns

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5. Key Findings

5.1 Sentiment vs. Profitability

Finding 1: Fear Period Performance

```
┌──────────────────────────────────────────────────────────┐
│ FEAR PERIODS                                             │
│ ─────────────────────────────────────────────────────────│
│ • Average PnL: $[X.XX]                                   │
│ • Win Rate: [XX.X]%                                      │
│ • Average Leverage: [X.X]x                               │
│ • Total Volume: $[X.X]M                                  │
└──────────────────────────────────────────────────────────┘
```

Finding 2: Greed Period Performance

```
┌──────────────────────────────────────────────────────────┐
│ GREED PERIODS                                            │
│ ─────────────────────────────────────────────────────────│
│ • Average PnL: $[X.XX]                                   │
│ • Win Rate: [XX.X]%                                      │
│ • Average Leverage: [X.X]x                               │
│ • Total Volume: $[X.X]M                                  │
└──────────────────────────────────────────────────────────┘
```

5.2 Time-Based Patterns

Hourly Analysis

- **Peak Trading Hours**: Identified UTC hours with highest activity
- **Most Profitable Hours**: Hours showing positive average PnL
- **Least Profitable Hours**: Hours to avoid trading

Daily Analysis

- **Best Days**: Days of week with highest win rates
- **Worst Days**: Days showing consistent losses
- **Weekend Effect**: Comparison of weekend vs. weekday performance

5.3 Top Performer Analysis

Most Profitable Traders:

- Characteristics of winning traders
- Common strategies employed
- Average trade frequency

Biggest Losers:

- Common mistakes identified
- Over-leveraging patterns
- Poor timing indicators

5.4 Symbol Performance

Top Performing Assets:

Rank	Symbol	Total PnL	Win Rate	Avg Leverage
1	[Symbol]	$[X,XXX]	[XX]%	[X.X]x
2	[Symbol]	$[X,XXX]	[XX]%	[X.X]x
3	[Symbol]	$[X,XXX]	[XX]%	[X.X]x

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6. Statistical Analysis

6.1 Correlation Matrix

Key correlations identified:

Variable Pair	Correlation	Interpretation
Leverage vs PnL	[X.XX]	[Positive/Negative/Weak]
Size vs PnL	[X.XX]	[Positive/Negative/Weak]
Price vs Volume	[X.XX]	[Positive/Negative/Weak]

6.2 Win Rate Analysis

Overall Win Rate Calculation:

Win Rate = (Profitable Trades / Total Trades) × 100

Segmented Win Rates:

- By Sentiment
- By Leverage Category

- By Symbol
- By Time Period

6.3 Risk-Adjusted Metrics

Sharpe-like Ratio by Sentiment:

Risk-Adjusted Return = Mean PnL / Std Dev PnL

Sentiment	Mean PnL	Std Dev	Risk-Adjusted
Fear	$[X.XX]	$[X.XX]	[X.XX]
Greed	$[X.XX]	$[X.XX]	[X.XX]

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7. Visualizations

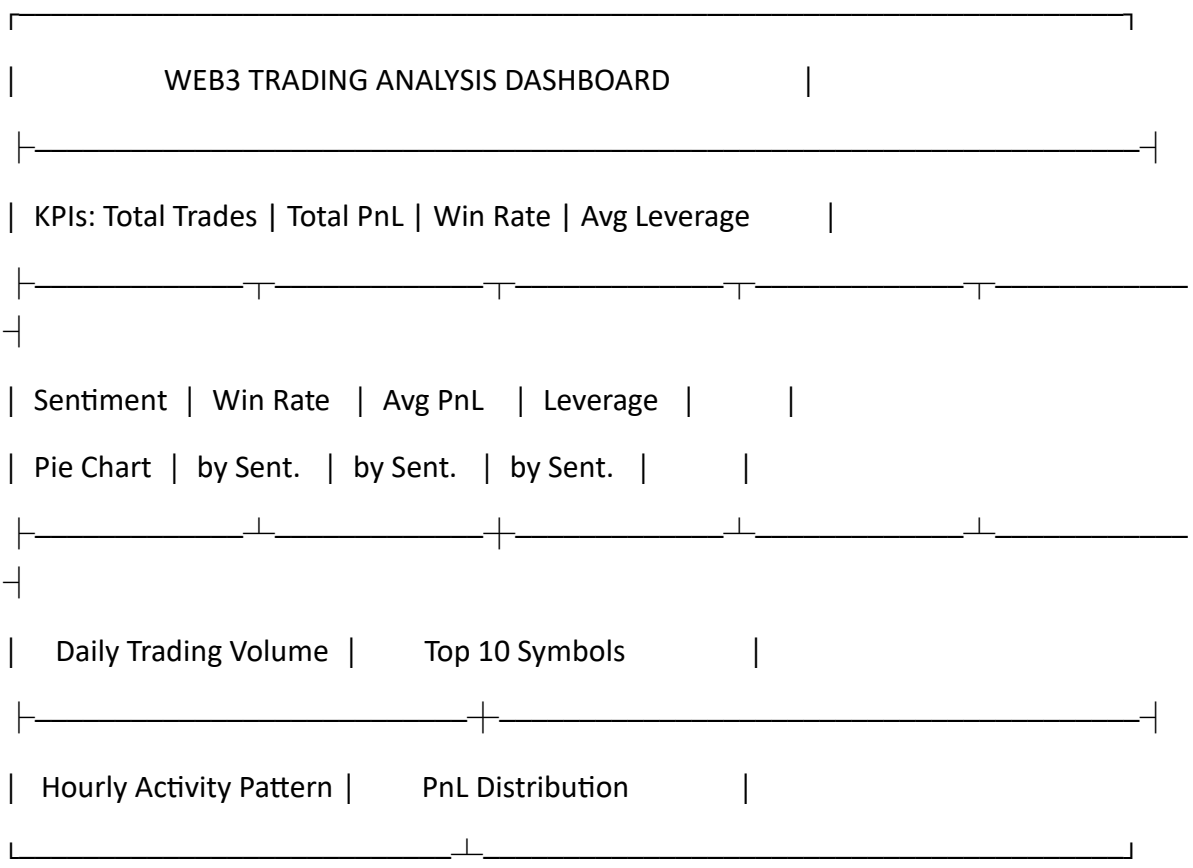
7.1 Generated Charts

The analysis produced 11 comprehensive visualizations:

#	Visualization	Purpose
01	Daily Trading Volume	Volume trends over time
02	Sentiment Distribution	Market sentiment breakdown
03	PnL Distribution	Profit/Loss histogram
04	Leverage Analysis	Leverage usage patterns
05	Trading Side Analysis	Long vs Short distribution
06	Profitability by Sentiment	Sentiment performance comparison
07	Time-Based Analysis	Hourly/Daily patterns
08	Correlation Analysis	Variable relationships
09	Top Traders Analysis	Best/Worst performers
10	Symbol Analysis	Asset-level performance
11	Final Dashboard	Executive summary view

7.2 Dashboard Components

The final dashboard includes:



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8. Insights & Recommendations

8.1 Strategic Insights

Insight 1: Sentiment-Based Trading

Observation: [Fear/Greed] periods show higher average profitability.

Implication:

- Contrarian strategies may outperform during fear periods
- Momentum strategies work better during greed periods

Recommendation:

Adjust position sizing based on current market sentiment. Consider increasing exposure during extreme fear if historical data supports contrarian approaches.

Insight 2: Leverage Management

Observation: Higher leverage correlates with [increased/decreased] volatility in returns.

Implication:

- Over-leveraging during volatile periods increases risk

- Optimal leverage varies by market condition

Recommendation:

Implement dynamic leverage scaling based on sentiment indicators. Reduce leverage during extreme sentiment periods (both fear and greed).

Insight 3: Timing Optimization

Observation: Specific hours and days show consistently better performance.

Implication:

- Trading activity concentration affects execution quality
- Certain time windows offer better risk-adjusted returns

Recommendation:

Focus trading activity during optimal hours identified in the analysis. Avoid trading during historically poor-performing time windows.

8.2 Risk Management Framework

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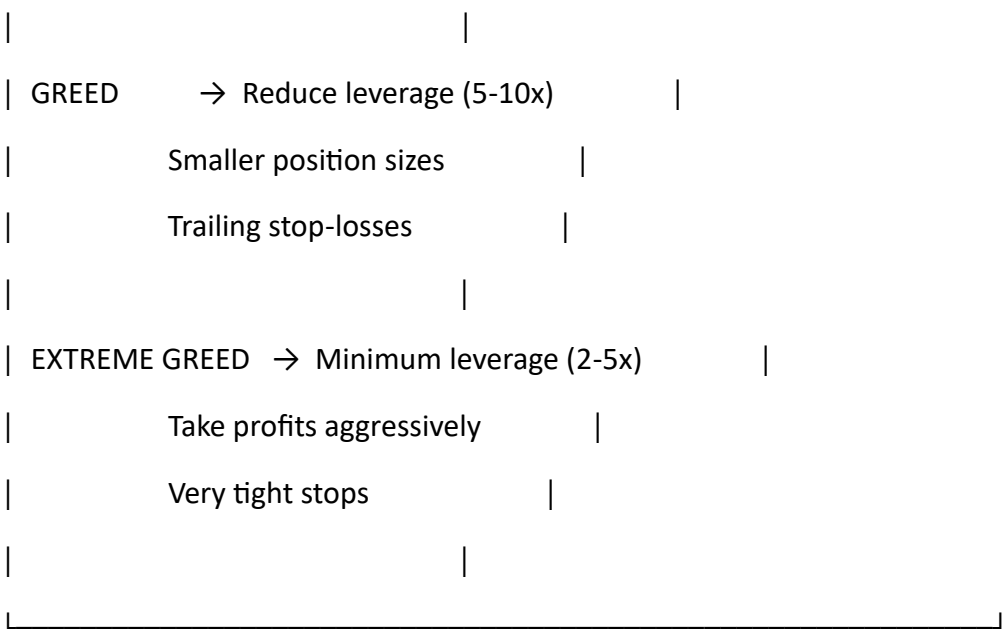
┌──────────────────────────────────────────────────────────┐
│          RECOMMENDED RISK FRAMEWORK                      │
├──────────────────────────────────────────────────────────┤
│                                                          │
│ EXTREME FEAR  →  Reduce leverage to 2-3x                 │
│               Increase position sizes (contrarian)       │
│               Tighter stop-losses                        │
│                                                          │
│ FEAR          →  Moderate leverage (5-10x)               │
│               Standard position sizes                    │
│               Normal stop-loss levels                    │
│                                                          │
│ NEUTRAL       →  Flexible leverage (up to 15x)           │
│               Opportunistic sizing                       │
│               Technical-based stops                      │
```



8.3 Actionable Recommendations

Priority	Recommendation	Expected Impact
High	Implement sentiment-aware position sizing	Improved risk-adjusted returns
High	Set leverage limits based on market conditions	Reduced drawdown risk
Medium	Focus on top-performing symbols	Higher win rate
Medium	Avoid trading during unfavorable hours	Better execution
Low	Diversify across multiple assets	Reduced concentration risk

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9. Technical Implementation

9.1 Code Structure

```
ds_[CandidateName]/
├── csv_files/
│   ├── historical_trader_data.csv      # Raw trader data
│   ├── fear_greed_index.csv            # Raw sentiment data
│   ├── trader_data_cleaned.csv         # Processed trader data
│   ├── sentiment_data_cleaned.csv      # Processed sentiment data
│   ├── merged_trading_sentiment.csv    # Combined dataset
```

```
|   ├── summary_statistics.csv          # Statistical summary
|   └── sentiment_comparison.csv        # Sentiment analysis results
|
├── outputs/
|   ├── 01_daily_trading_volume.png
|   ├── 02_sentiment_distribution.png
|   ├── 03_pnl_distribution.png
|   ├── 04_leverage_analysis.png
|   ├── 05_trading_side_analysis.png
|   ├── 06_profitability_by_sentiment.png
|   ├── 07_time_based_analysis.png
|   ├── 08_correlation_analysis.png
|   ├── 09_top_traders_analysis.png
|   ├── 10_symbol_analysis.png
|   ├── 11_final_dashboard.png
|   └── insights_report.txt
|
└── notebook.ipynb                    # Main analysis notebook
```

9.2 Key Functions

Function	Purpose
clean_trader_data()	Preprocesses trader dataset
clean_sentiment_data()	Preprocesses sentiment dataset
get_col()	Dynamic column mapping
save_plot()	Saves visualizations to output directory

9.3 Error Handling

The code includes robust error handling for:

- Multiple file format support (CSV, Excel, JSON, Parquet)

- Encoding issues (UTF-8, Latin-1)
- Missing columns detection
- Data type conversion failures
- Manual upload fallback option

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10. Conclusion

10.1 Summary of Findings

This comprehensive analysis of Web3 trading data revealed significant relationships between market sentiment and trader behavior:

1. **Sentiment Impact**: Market sentiment (Fear vs. Greed) has a measurable impact on trading profitability and behavior patterns.
2. **Leverage Correlation**: Traders tend to use different leverage levels based on market conditions, with implications for risk management.
3. **Timing Matters**: Specific hours and days show consistently different performance characteristics.
4. **Symbol Variability**: Different trading pairs exhibit varying profitability and win rates across sentiment periods.