ILLINOIS

# Quantamental Investments Final Project

Group 3

05/09/2025

# Meet the Team

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# Agenda

1. Title & Research Objectives
2. Alternative-Data Factor Design
3. Investment Universe & Multi-Agent Architecture
4. Key Backtest Results
5. Conclusions & Future Work

# Title and Research Objective

# Title & Research Objective

## Multi-Factor System for Cryptocurrency Trading: Quantifying Alternative Data for Bitcoin (BTC) and Ethereum (ETH)

**Research Objective:**

1. Integrate crypto news sentiment and On-Chain data into a collaborative trading framework
2. Improve crypto trading performance using alternative data from cryptoquant with momentum

**Motivation and Literature Gap:**

- ✓ Existing studies integrating sentiment, find Alpha (e.g., Twitter, News)
- ✓ Existing studies integrating alternative data, find Alpha (e.g., GitHub, On-Chain Data)
- ✓ Our work combines that into more Alpha

# Alternative-Data Factor Design

# Alternative Data Factor Design (Sentiment)

## Data Sources

1. (CryptoNewsAPI) Pre-labeled news articles on BTC and ETH
2. (Alternative.me) Fear & Greed Index

## Sentiment Labeling

FinBert NLP tool → scores classified as:

- Positive
- Neutral
- Negative

## Signal Output

✓ Sentiment score aggregated daily

Transformed into discrete trading signal:

- Buy (1)
- Hold (0)
- Sell (-1)

## Output

**Sentiment score** → Discrete signal used by sentiment agent where the output is fed to the Model agent

# Alternative Data Factor (Historical News)

| Title | Text | Date | Sentiment |
|---|---|---|---|
| 2021 Bitcoin Price Predictions: Is The Massive Bitc | As the bitcoin price hovers under the psychologic | 1/1/2021 | -1 |
| Bitcoin Is Digital Social Justice, feat. Tyrone Ross | The podcaster and CEO of Onramp Invest discuss | 1/1/2021 | 0 |
| The Last Time This Indicator Flashed, Bitcoin Drop | Bitcoin has been facing some turbulence as of lat | 1/1/2021 | -1 |
| Fundstrat Analyst Tom Lee Reveals Bitcoin Price P | Fundstrat analyst and executive Tom Lee thinks Bi | 1/1/2021 | 0 |
| Grayscale Hits $20 billion in AUM as Bitcoin's Pric | Bitcoin's skyrocketing price has pushed Grayscal | 1/1/2021 | 0 |
| How long can Bitcoin stay #1? Here's an analysis | Bitcoin is the largest cryptocurrency in the world a | 1/1/2021 | -1 |
| Here's why the next 8 years will be important for Bi | Comparing Bitcoin with the traditional asset class | 1/1/2021 | 1 |
| Bitcoin Leaves Other Assets Behind in 2020. And 2 | Bitcoin had a very good year in 2020. Messari's ch | 1/1/2021 | 1 |
| Will Central Banks Hold Bitcoin in 2021? | Central banks (CB) will hold bitcoin sooner or late | 1/1/2021 | 0 |
| Bitcoin hits all-time high against gold as haven ba | BTC has hit another milestone, this time against g | 1/1/2021 | 1 |
| BTC to Gold Exchange Rate Surges to New All Time | Bitcoin's record-breaking rally is continuing into t | 1/2/2021 | 1 |
| Bitcoin Options on Deribet Now Go to $200K After | The folks over at Deribit apparently think the recer | 1/2/2021 | 1 |
| When Will Bitcoin Production Stop? | Anyone who learns about Bitcoin's technology wil | 1/2/2021 | 0 |
| Bitcoin Price Touches $33,000 in Unstoppable Ral | Bitcoin price has hit $33,000 for the first time ever | 1/2/2021 | 1 |
| How massive Bitcoin buyer activity on Coinbase p | The price of Bitcoin surged past $32,000 as buyers | 1/2/2021 | 1 |
| BREAKING: Bitcoin Hurdles $31,000; Now at $32,0( | Bitcoin reached a psychologically important all ti | 1/2/2021 | 1 |
| Bitcoin Momentum Likely to Continue as Bulls Sha | Bitcoin has seen some massive momentum throu | 1/2/2021 | 1 |
| 3 Key Reasons Why Bitcoin Price Just Exploded Pa | Bitcoin moves past $23,500 for the first time ever a | 1/2/2021 | 1 |
| Bitcoin Surge Isn't Over Yet, Why BTC Could Hit $34 | Bitcoin price remained in a bullish zone and clim | 1/2/2021 | 1 |

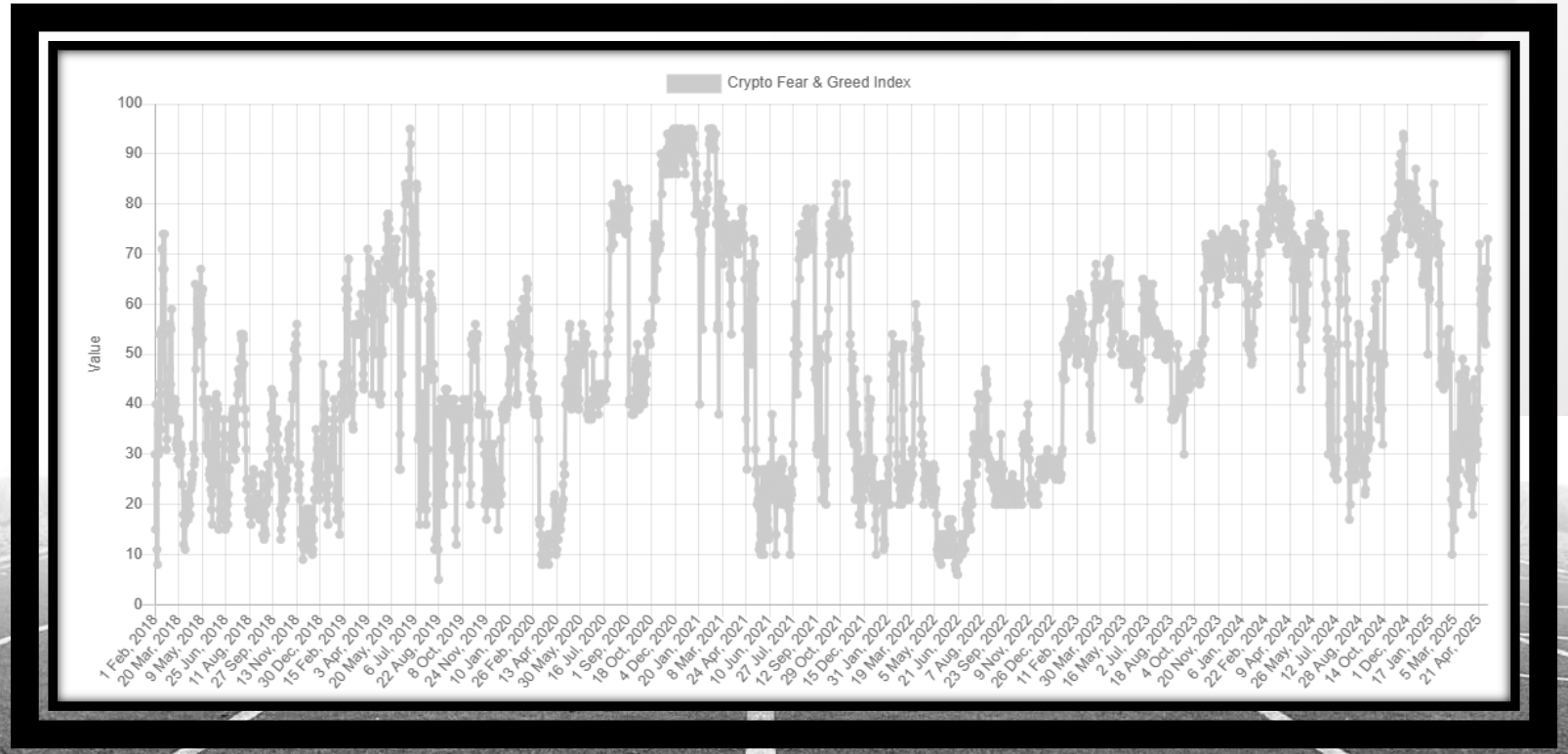
| CryptoNews | Finbert | Final |
|---|---|---|
| 0 | 0 | 0 |
| 1 | 1 | 1 |
| 1 | 0 | 0 |
| -1 | -1 | -1 |
| 1 | 1 | 1 |
| 1 | 1 | 1 |
| 1 | 0 | 0 |
| 1 | 1 | 1 |
| 1 | 0 | 0 |
| 1 | 0 | 0 |
| 1 | 0 | 0 |
| -1 | -1 | -1 |
| 1 | 0 | 0 |
| 0 | 0 | 0 |
| 0 | 0 | 0 |
| 0 | 0 | 0 |
| 0 | 1 | 1 |
| 0 | -1 | -1 |
| 0 | 0 | 0 |
| 0 | 0 | 0 |

# Alternative Data Factor (F/G)

**Fear & Greed Index as Alternative Data for MAS**

In crypto markets, investor behavior is highly emotional. Greed drives FOMO during price surges, while fear leads to panic selling during downturns. This behavior can create inefficiencies in pricing.

- **Extreme Fear** often reflects excessive market overselling — signaling a buying opportunity.
- **Extreme Greed** typically indicates overconfidence — market may be due for a correction.



# Alternative Data Factor (F/G)

**Volatility (25%)**
Compares recent Bitcoin volatility and drawdowns to 30- and 90-day averages.
A sharp increase signals rising fear in the market.

**Market Momentum & Volume (25%)**
Looks at current trading volume and price momentum relative to recent averages.
Strong positive momentum and high volume indicate growing greed.

**Social Media (15%)**
Analyzes Twitter activity based on hashtags and engagement levels.
A surge in posts and rapid interaction points to heightened greed and excitement.

**Surveys (15%)**
Previously conducted weekly polls with thousands of responses.
Helped capture retail sentiment early in the index's development.

**Dominance (10%)**
Measures Bitcoin’s market cap share relative to all crypto.
Rising BTC dominance suggests fear (shift to safer assets); declining dominance indicates greed (risk-seeking behavior in altcoins).

**Google Trends (10%)**
Tracks search interest in Bitcoin-related topics.
Spikes in fear-related searches, like “Bitcoin crash,” reflect market anxiety.

# Alternative Data Factor Design

## Data Sources

On-chain and other metrics - CryptoQuant.Com

- Exchange net flow
- Open Interest
- MVRV ratio (BTC)
- Gas price (ETH)
- Taker buy sell ratio
- Taker sentiment

## Feeding into the model

Tested against 5 models to find out the best

- XGBoost
- Random Forest
- CNN
- MLP regressor
- Random forest + LSTM ensemble

## Model Testing

- ✓ Models provided quantitative relationship between return and on-chain data
- ✓ Best model used to predict returns

## Output

Discrete understanding of the alternate data factors quantitatively

# Exchange Netflow

# Open Interest

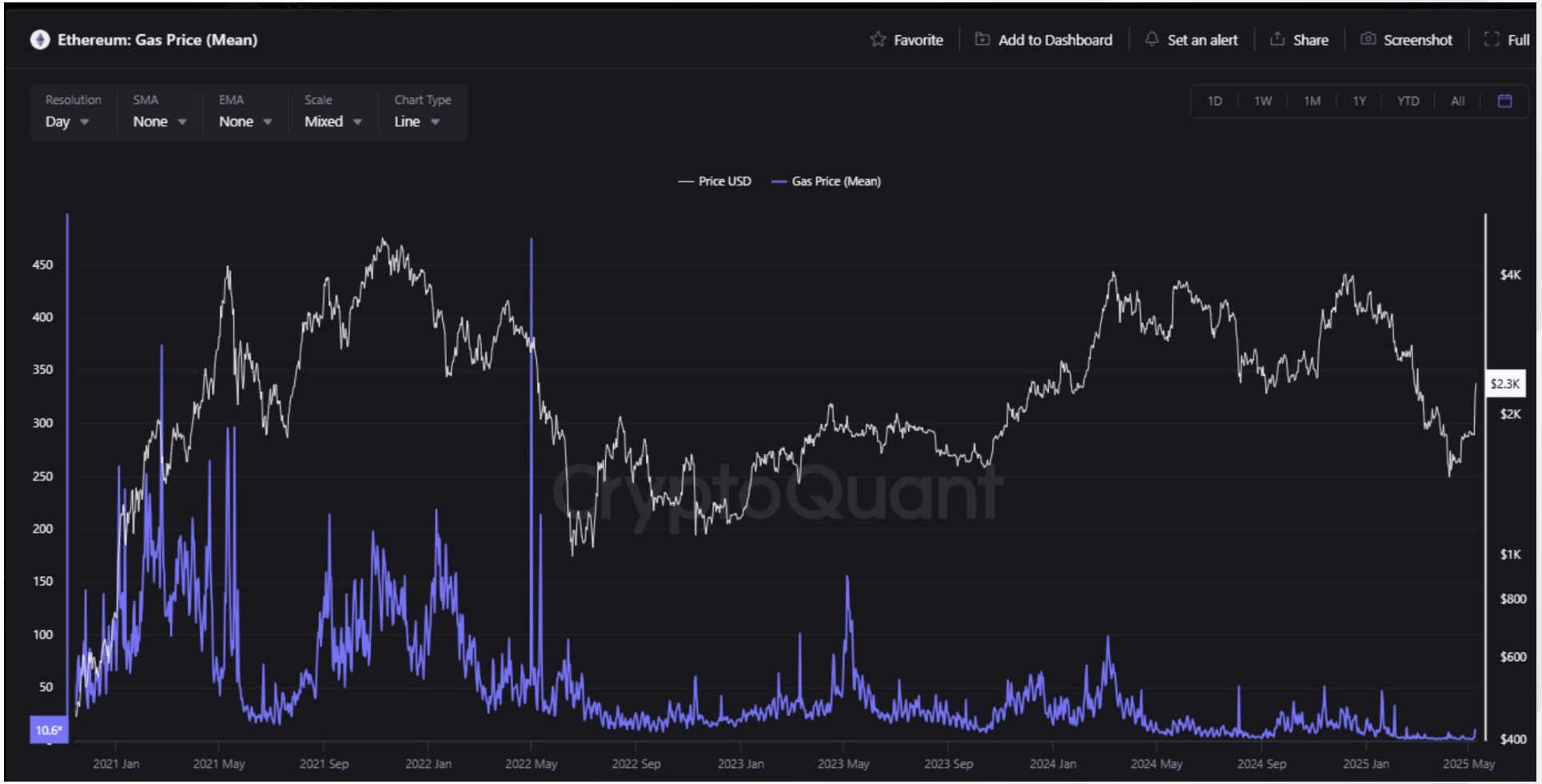
# MVRV Ratio


Bitcoin: MVRV Ratio
Favorite
Add to Dashboard
Set an alert
Share
Screenshot
Full
Resolution
Day
SMA
None
EMA
None
Scale
Log
Chart Type
Line
1D
1W
1M
1Y
YTD
All
Price USD
MVRV Ratio
$102.8K
$90K
$80K
$70K
$60K
$50K
$40K
$30K
$20K
2
1.8*
1
0.9
0.8
CryptoQuant
2022 Jul
2022 Oct
2023 Jan
2023 Apr
2023 Jul
2023 Oct
2024 Jan
2024 Apr
2024 Jul
2024 Oct
2025 Jan
2025 Apr

# MVRV Ratio


BTC: Market Value to Realized Value (MVRV) Ratio
Price USD
BTC: Market Value to Realized Value (MVRV) Ratio
MVRV > 3.7 AREA
Possible Market Top
MVRV < 1 AREA
Possible Market Bottom
Reset zoom
CryptoQuant
5
4
3
2
1
0
75.00K
60.00K
45.00K
30.00K
15.00K
0
Jan '17
Jul '17
Jan '18
Jul '18
Jan '19
Jul '19
Jan '20
Jul '20
Jan '21
Jul '21
Last Value: 1.9782
Day
Block

# Eth Gas


Ethereum: Gas Price (Mean)
Favorite
Add to Dashboard
Set an alert
Share
Screenshot
Full
Resolution
Day
SMA
None
EMA
None
Scale
Mixed
Chart Type
Line
1D
1W
1M
1Y
YTD
All
Price USD
Gas Price (Mean)
450
400
350
300
250
200
150
100
50
10.6*
$4K
$2.3K
$2K
$1K
$800
$600
$400
2021 Jan
2021 May
2021 Sep
2022 Jan
2022 May
2022 Sep
2023 Jan
2023 May
2023 Sep
2024 Jan
2024 May
2024 Sep
2025 Jan
2025 May
CryptoQuant

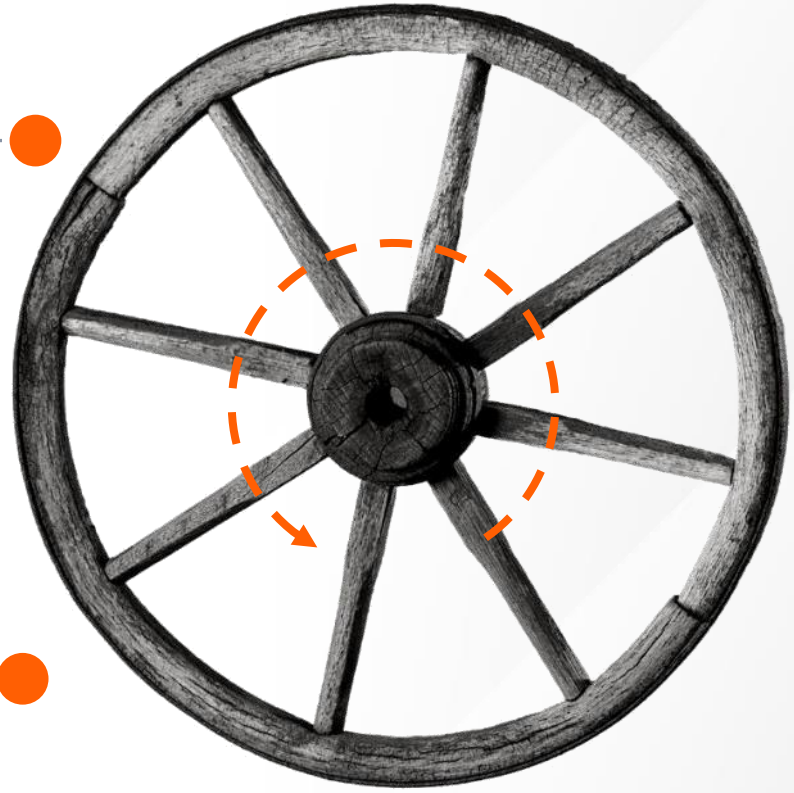
# Taker Buy Sell Ratio

# Investment Universe & Multi-Agent Architecture

# Investment Universe and Multi-Agent Design

**Asset Focus: BTC & ETH**

**Sentiment Agent**
Sentiment scoring and on-chain data analysis



**Trading agent**
Managing the investments based on signals

**Model Agent**
Build prediction model for returns

# Model Training and Testing

# OLS results for Quantification of effects

OLS Regression Results

| | | | |
|---|---|---|---|
| Dep. Variable: | Return | R-squared: | 0.709 |
| Model: | OLS | Adj. R-squared: | 0.706 |
| Method: | Least Squares | F-statistic: | 248.2 |
| Date: | Fri, 09 May 2025 | Prob (F-statistic): | 0.00 |
| Time: | 04:25:15 | Log-Likelihood: | 3780.0 |
| No. Observations: | 1444 | AIC: | -7530. |
| Df Residuals: | 1429 | BIC: | -7451. |
| Df Model: | 14 | | |
| Covariance Type: | nonrobust | | |

| | coef | std err | t | P>\|t\| | [0.025 | 0.975] |
|---|---|---|---|---|---|---|
| const | -0.3641 | 0.014 | -25.651 | 0.000 | -0.392 | -0.336 |
| volume | -2.185e-10 | 2.34e-11 | -9.326 | 0.000 | -2.64e-10 | -1.73e-10 |
| sentiment | 0.0014 | 0.001 | 2.195 | 0.028 | 0.000 | 0.003 |
| Taker Buy Sell Ratio | 0.3415 | 0.013 | 26.983 | 0.000 | 0.317 | 0.366 |
| MVRV Ratio | 0.0157 | 0.002 | 8.523 | 0.000 | 0.012 | 0.019 |
| Open Interest | -2.758e-13 | 1.23e-13 | -2.244 | 0.025 | -5.17e-13 | -3.47e-14 |
| Funding Rates | -0.0843 | 0.038 | -2.222 | 0.026 | -0.159 | -0.010 |
| Estimated Leverage Ratio | 0.0500 | 0.018 | 2.845 | 0.004 | 0.016 | 0.084 |
| Exchange Netflow (Total) | -1.344e-08 | 5.14e-08 | -0.262 | 0.794 | -1.14e-07 | 8.73e-08 |
| fng_value | -0.0003 | 0.000 | -2.504 | 0.012 | -0.000 | -5.94e-05 |
| Daily_sentiment | 0.0015 | 0.001 | 2.293 | 0.022 | 0.000 | 0.003 |
| lag_return_1 | -0.3124 | 0.023 | -13.805 | 0.000 | -0.357 | -0.268 |
| lag_fng | 0.0002 | 0.000 | 1.487 | 0.137 | -5.16e-05 | 0.000 |
| ma_3 | 0.9246 | 0.037 | 24.950 | 0.000 | 0.852 | 0.997 |
| volatility_3 | 0.1236 | 0.029 | 4.283 | 0.000 | 0.067 | 0.180 |

| | | | |
|---|---|---|---|
| Omnibus: | 105.170 | Durbin-Watson: | 2.020 |
| Prob(Omnibus): | 0.000 | Jarque-Bera (JB): | 501.899 |
| Skew: | -0.100 | Prob(JB): | 1.03e-109 |
| Kurtosis: | 5.881 | Cond. No. | 1.10e+12 |

BTC

OLS Regression Results

| | | | |
|---|---|---|---|
| Dep. Variable: | Return | R-squared: | 0.657 |
| Model: | OLS | Adj. R-squared: | 0.654 |
| Method: | Least Squares | F-statistic: | 195.6 |
| Date: | Fri, 09 May 2025 | Prob (F-statistic): | 1.30e-319 |
| Time: | 04:25:30 | Log-Likelihood: | 3309.9 |
| No. Observations: | 1444 | AIC: | -6590. |
| Df Residuals: | 1429 | BIC: | -6511. |
| Df Model: | 14 | | |
| Covariance Type: | nonrobust | | |

| | coef | std err | t | P>\|t\| | [0.025 | 0.975] |
|---|---|---|---|---|---|---|
| const | -0.3713 | 0.018 | -20.597 | 0.000 | -0.407 | -0.336 |
| volume | -4.624e-11 | 6.51e-12 | -7.104 | 0.000 | -5.9e-11 | -3.35e-11 |
| sentiment | 0.0014 | 0.001 | 1.479 | 0.139 | -0.000 | 0.003 |
| Taker Buy Sell Ratio | 0.3785 | 0.017 | 21.885 | 0.000 | 0.345 | 0.412 |
| Gas Price (Mean) | -1.747e-05 | 1.96e-05 | -0.892 | 0.373 | -5.59e-05 | 2.1e-05 |
| Open Interest | 3.414e-12 | 4.16e-13 | 8.197 | 0.000 | 2.6e-12 | 4.23e-12 |
| Funding Rates | 0.0006 | 0.033 | 0.018 | 0.985 | -0.063 | 0.064 |
| Estimated Leverage Ratio | -0.0919 | 0.016 | -5.671 | 0.000 | -0.124 | -0.060 |
| Exchange Netflow (Total) | -1.915e-09 | 7.23e-09 | -0.265 | 0.791 | -1.61e-08 | 1.23e-08 |
| fng_value | 6.291e-05 | 0.000 | 0.465 | 0.642 | -0.000 | 0.000 |
| Daily_sentiment | 0.0014 | 0.001 | 1.610 | 0.108 | -0.000 | 0.003 |
| lag_return_1 | -0.3907 | 0.022 | -17.953 | 0.000 | -0.433 | -0.348 |
| lag_fng | -4.342e-05 | 0.000 | -0.326 | 0.744 | -0.000 | 0.000 |
| ma_3 | 1.0647 | 0.038 | 27.886 | 0.000 | 0.990 | 1.140 |
| volatility_3 | 0.1822 | 0.029 | 6.200 | 0.000 | 0.125 | 0.240 |

| | | | |
|---|---|---|---|
| Omnibus: | 181.399 | Durbin-Watson: | 2.027 |
| Prob(Omnibus): | 0.000 | Jarque-Bera (JB): | 1520.570 |
| Skew: | -0.255 | Prob(JB): | 0.00 |
| Kurtosis: | 8.001 | Cond. No. | 4.53e+11 |

ETH

# Model Designing and Testing

| Model | $R^2$ Score | MSE |
|---|---|---|
| Random Forest | 0.7469 | 0.000194 |
| MLP Regressor | -20.6623 | 0.011642 |
| XGBoost | 0.4234 | 0.000310 |
| CNN | -1.0150 | 0.000858 |
| Hybrid Ensemble | 0.0044 | 0.000536 |

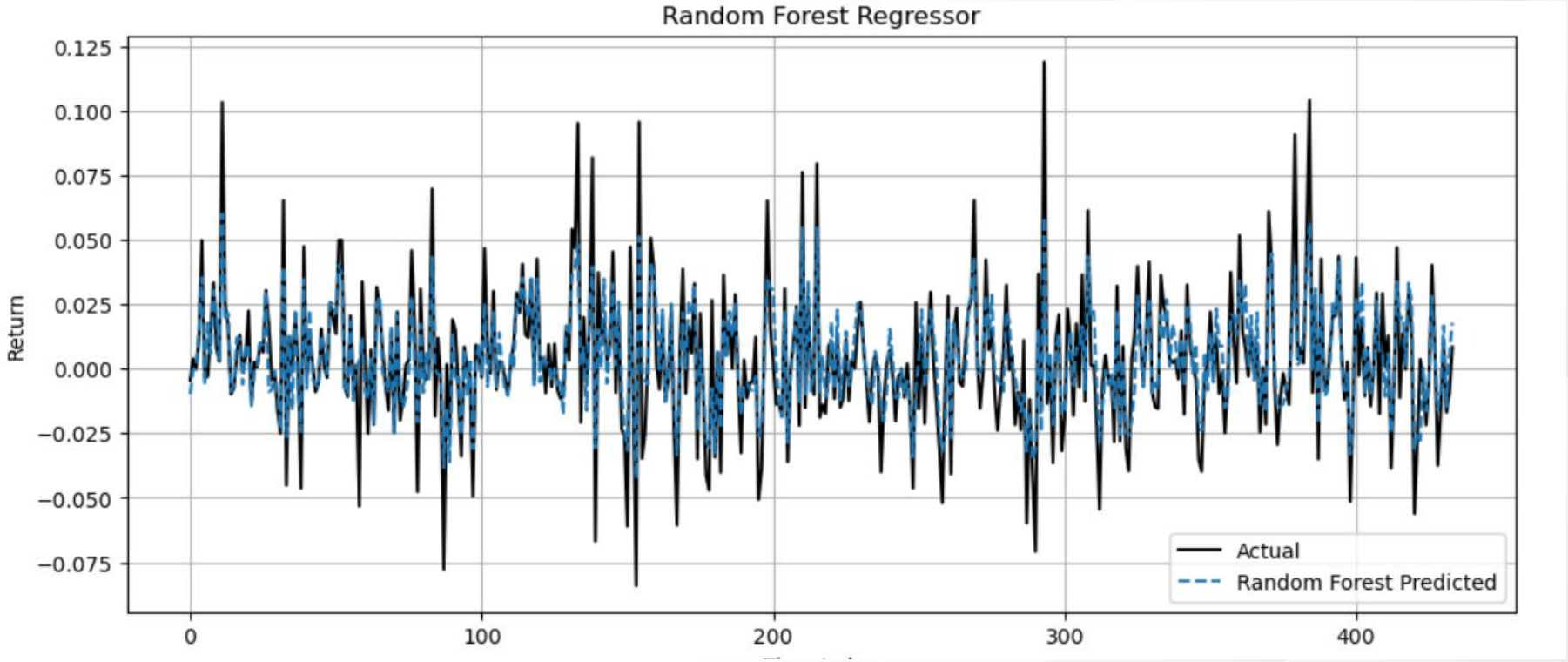
**Model Designing Specifics -**

- Train test split functionality to ensure training and testing for prediction – 70:30
- R-squared and MSE = Evaluation factors of the model performance
- Each input factor included either as a naturally coded numerical factor or codified into numeric values
- Using the prediction functionality, predicted the returns for the test set along with converting them into Buy/Sell signals

# Model Designing and Testing

**BEST Model = Random Forest regressor**

- R-squared value of 0.7469
- MSE of 0.00194



# Key Backtesting Results

# Back-trading Results - BTC

**Strategy Logic -**

**Enter Long** if:

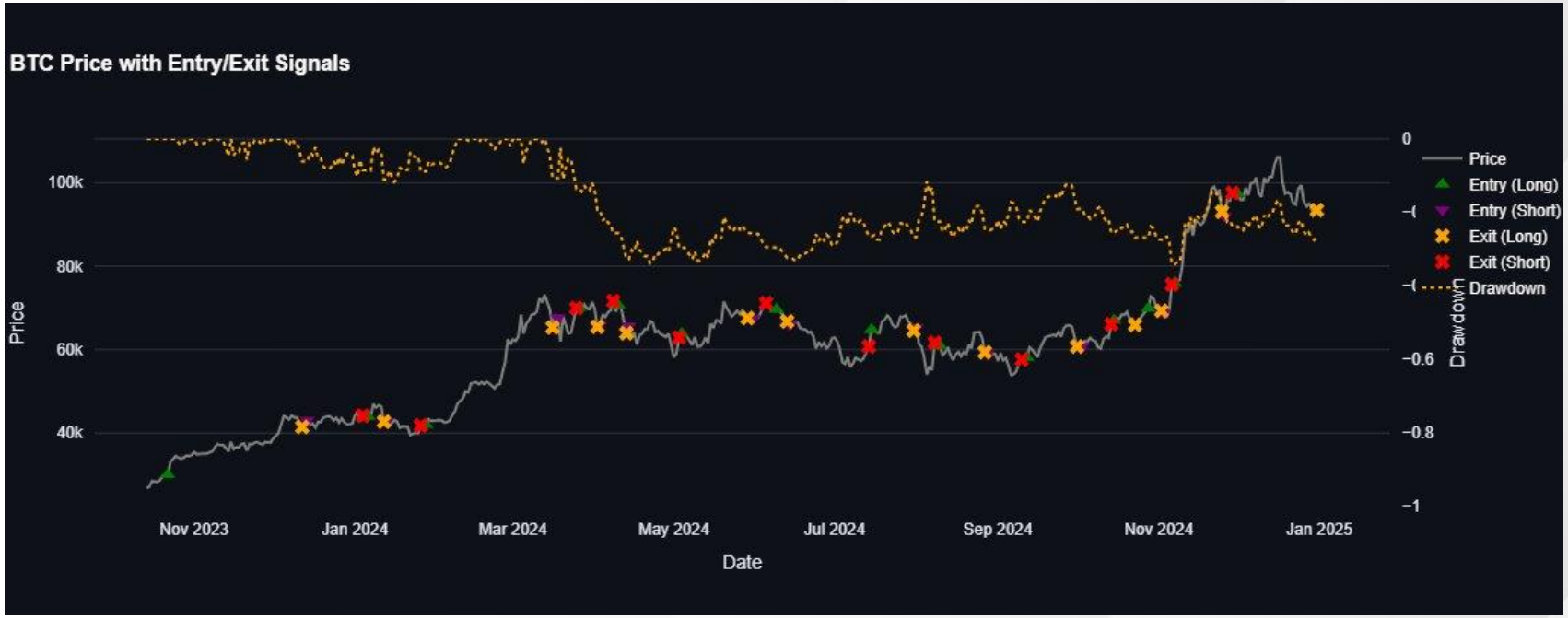
- Signal = Buy **and** Price > MA(9)

**Enter Short** if:

- Signal = Sell **and** Price < MA(9)

**Exit Position** if:

- Price hits a **trailing stop-loss** set at **ATR(14)** × **multiplier**
- Multiplier: 1.5 for BTC




✓ No lookahead bias

✓ No overfitting

# Back-trading Results - ETH

**Strategy Logic -**

**Enter Long** if:

- Signal = Buy **and** Price > MA(9)

**Enter Short** if:

- Signal = Sell **and** Price < MA(9)

**Exit Position** if:

- Price hits a **trailing stop-loss** set at **ATR(14)** × **multiplier**
- Multiplier: 2.0 for ETH


✓ No lookahead bias

✓ No overfitting

# Conclusions & Future Work

# Conclusion & Future Work

**Conclusion :**

- ✓ We successfully designed and tested **two alternative data factors**:
  1. **Sentiment-based** (news + Fear & Greed Index)
  2. **On-chain metrics** (crypto market behavior)
- ✓ Our **multi-agent model** processes these factors to generate daily trading signals.
- ✓ Results show **potential predictive power**, with agents using non-traditional data sources to improve market insights.

**Future Work:**

- ✓ **Expand asset coverage**: Apply the framework to more crypto or traditional assets (e.g., QQQ, SPY).
- ✓ **Real-time pipeline**: Automate data ingestion and model updates for live trading.
- ✓ **Ensemble improvement**: Combine sentiment and on-chain models for stronger consensus signals.
- ✓ **Refine signal timing**: Add volatility filters or trend confirmation to reduce noise.