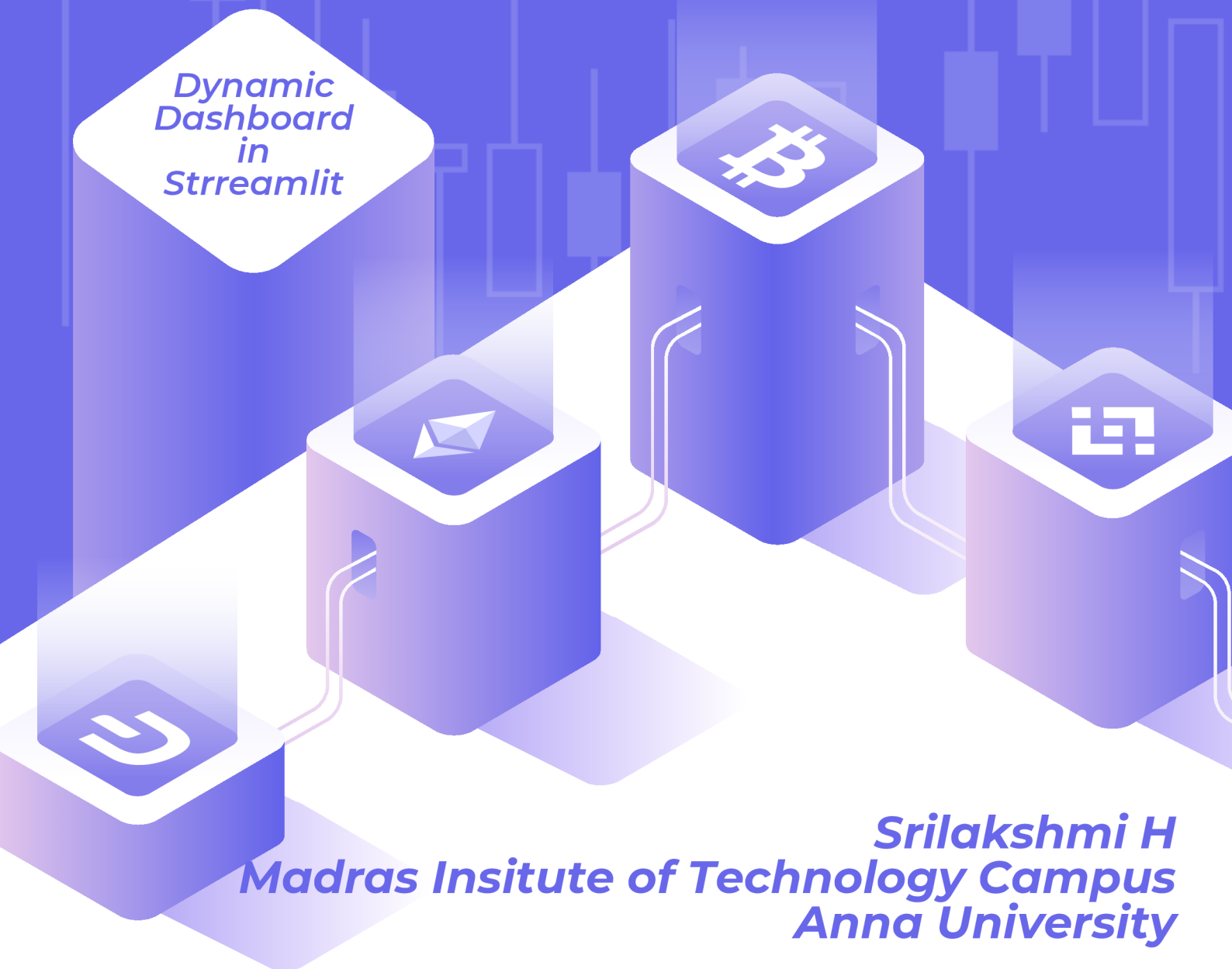


QUANTUM QUOTIENT ANALYSIS

Stock Analysis Dashboard

*Dynamic
Dashboard
in
Streamlit*



*Srilakshmi H
Madras Insitute of Technology Campus
Anna University*

Transforming Data into Powerful Dashboards

1. Introduction

Quantum Quotient Analytics is an **interactive financial analytics dashboard** designed to provide **detailed stock market analysis** using real-time and historical data. This Streamlit-based platform empowers users with insights into price trends, volatility, market behavior, comparative analysis, and predictive modeling using machine learning.

2. Objectives

- Provide real-time and historical stock data in an interactive manner.
- Implement technical indicators for trend, volatility, and volume-based analysis.
- Enable comparative statistical analysis between multiple stocks.
- Develop a machine learning model (Random Forest Regressor) to predict closing prices.
- Offer data visualization using Plotly for a more intuitive experience.

3. Methodology

The dashboard consists of five key modules, each offering unique insights into stock performance.

1. Basic Information

- **Stock Market Analytics Table:** Displays fundamental stock data.
- **Loading the Data:** Fetches stock data dynamically from Yahoo Finance using `yfinance`.
- **Additional Information:** Provides company details, sector, and financial metrics.

2. Time Series Analysis

- **Closing Price Over Time:** Tracks stock price trends.
- **Volume Traded Over Time:** Analyzes trading volume fluctuations.
- **Opening vs Closing Prices:** Highlights price movement patterns.
- **Time Series Decomposition:** Breaks time series into trend, seasonality, and residuals.
- **OHLC Chart (Candlestick Chart):** Displays open-high-low-close movements.

3. Technical Indicators & Trend Analysis

Price Trend & Moving Averages

- **Simple Moving Average (SMA) & Exponential Moving Average (EMA):** Identifies trend direction.
- **VWAP (Volume-Weighted Average Price):** Tracks average price based on volume.
- **MACD Indicator:** Measures trend strength and momentum.

Volatility & Risk Metrics

- **Annualized Volatility:** Estimates price fluctuations over time.
- **Average True Range (ATR):** Determines market volatility.
- **Ulcer Index:** A risk indicator for drawdowns.

Momentum & Overbought/Oversold Indicators

- **Relative Strength Index (RSI):** Detects overbought/oversold levels.
- **Stochastic Oscillator & Fisher Transform:** Identifies potential reversals.

Volume-Based Indicators

- **On-Balance Volume (OBV):** Tracks volume momentum.
- **Intraday Intensity Index (IIX) & Chaikin Money Flow (CMF):** Measures buying/selling pressure.

Support, Resistance & Channel-Based Indicators

- **Bollinger Bands, Keltner Channel, Donchian Channels:** Identifies price ranges and breakouts.

Trade & Market Behavior Analysis

- **Number of Trades Over Time:** Evaluates trading activity.
- **Cumulative Return Plot:** Tracks portfolio returns.
- **Relative Performance Comparison:** Compares stock performance.
- **Elder's Force Index (EFI):** Measures trend strength based on price and volume.

4. Comparative & Statistical Analysis

- **Comparative Closing Prices:** Allows stock-to-stock comparisons.
- **Histogram of Returns:** Analyzes stock return distributions.

5. Predictive Modeling

- **Random Forest Regressor Model:**
 - Users input feature values.
 - The model predicts closing prices.
 - Displays Mean Squared Error (MSE) & R-Squared Score.
 - Interactive evaluation metrics plots visualize model performance.

4. Technology Stack

- **Python** for data processing and ML.
- **Streamlit** for the web-based interactive dashboard.
- **yfinance** for stock data retrieval.
- **Plotly** for interactive visualization.
- **Scikit-learn** for machine learning models.
- **Pandas & NumPy** for data manipulation.

5. Impact & Use Cases

- **Investors & Traders:** Helps make informed trading decisions.
- **Financial Analysts:** Assists in comparative market studies.
- **Academics & Researchers:** Provides a platform for financial data analysis.
- **Students & AI Enthusiasts:** Serves as a practical implementation of AI in finance.

6. Challenges & Solutions

- **Handling large financial datasets** - Optimized data processing techniques.
- **Ensuring real-time data updates** - Integrated yfinance API effectively.
- **Model accuracy for price prediction** - Tuned hyperparameters of Random Forest.
- **Performance issues with multiple indicators** - Used caching and efficient plotting techniques.

7. Future Scope

- Integration of LSTM models for better stock price forecasting.
- Incorporating more financial indicators for deeper insights.
- Enhancing UI/UX for improved user experience.
- Allowing real-time alerts for trading signals.

8. Conclusion

Quantum Quotient Analytics is a **powerful, data-driven financial analytics dashboard** designed to provide deep insights into **market trends, stock behavior, and predictive modeling**. With its interactive capabilities and AI-powered predictions, it serves as a valuable tool for both traders and analysts in **decision-making and investment strategy formulation**.

9. Snapshots of the Dashboard and the visualizations

Home page:



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Fork

Home

Basic Information

Time Series Analysis

Technical Indicators and Trend Analysis

Comparative and Statistical Analysis

Predictive Modeling

Quantum Quotient Analytics

Stock Data Table for AAPL

	Serial No.	Date	Open	High	Low	Close	Volume
	0	2021-01-04 00:00:00-05:00	130.4198	130.5077	123.8167	126.4052	143301900
	1	2021-01-05 00:00:00-05:00	125.8973	128.6811	125.448	127.9681	97664900
	2	2021-01-06 00:00:00-05:00	124.7545	128.0072	123.4456	123.6605	155088000
	3	2021-01-07 00:00:00-05:00	125.3796	128.5737	124.8912	127.8802	109578200
	4	2021-01-08 00:00:00-05:00	129.3551	129.5505	127.2062	128.984	105158200
	5	2021-01-11 00:00:00-05:00	126.1903	127.1476	125.5164	125.9852	100384500
	6	2021-01-12 00:00:00-05:00	125.5164	126.6788	123.9145	125.8094	91951100
	7	2021-01-13 00:00:00-05:00	125.7703	128.3979	125.5066	127.8509	88636800
	8	2021-01-14 00:00:00-05:00	127.763	127.9583	125.7703	125.9169	90221800
	9	2021-01-15 00:00:00-05:00	125.7899	127.1964	124.0512	124.1879	111598500

Company Information

Basic Information

Time Series Analysis

Technical Indicators and Trend Analysis

Comparative and Statistical Analysis

Predictive Modeling

Enter Stock Symbol (e.g., AAPL, TSLA)

AAPL

Start Date

2021/01/01

End Date

2025/04/02

	Serial No.	Date	Open	High	Low	Close	Volume
0	1	2021-01-04 00:00:00-05:00	130.4198	130.5077	123.8167	126.4052	143301900
1	2	2021-01-05 00:00:00-05:00	125.8973	128.6811	125.448	127.9681	97664900
2	3	2021-01-06 00:00:00-05:00	124.7545	128.0072	123.4456	123.6605	155088000
3	4	2021-01-07 00:00:00-05:00	125.3796	128.5737	124.8912	127.8802	109578200
4	5	2021-01-08 00:00:00-05:00	129.3551	129.5505	127.2062	128.984	105158200
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Home

Basic Information

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2021/01/01

End Date

2025/04/02

7	8	2021-01-13 00:00:00-05:00	125.7703	128.3979	125.5066	127.8509	88636800
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9	10	2021-01-15 00:00:00-05:00	125.7899	127.1964	124.0512	124.1879	111598500

Company Information

Company Name: Apple Inc.

Industry: Consumer Electronics

Exchange: NMS

Website: [Visit Website](#)

Market Cap: 3345125736448

P/E Ratio: 35.402275

Earnings Per Share (EPS): 6.29

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7	8	2021-01-13 00:00:00-05:00	125.7703	128.3979	125.5066	127.8509	88636800
8	9	2021-01-14 00:00:00-05:00	127.763	127.9583	125.7703	125.9169	90221800
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Earnings Per Share (EPS): 6.29

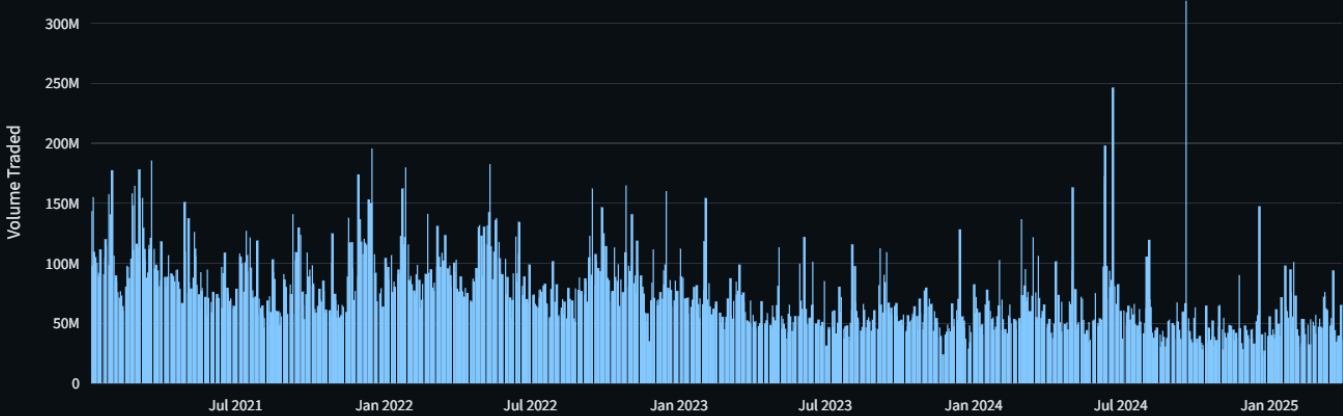
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Time Series Analysis for AAPL

The chart displays the closing price of the S&P 500 index over a four-year period. The y-axis represents the closing price in USD, ranging from 120 to 260. The x-axis shows the date from July 2021 to January 2025. The price begins at approximately 125 in July 2021, rises to a peak of about 180 in early 2022, then experiences a significant drop to around 125 in late 2022. Following this, the index shows a strong upward trend, reaching a new peak of approximately 255 in early 2025, before ending at about 210 in January 2025.

Volume Traded Over Time

This bar chart represents the number of shares traded daily. A sudden increase in volume may indicate strong investor interest and potential price movement.



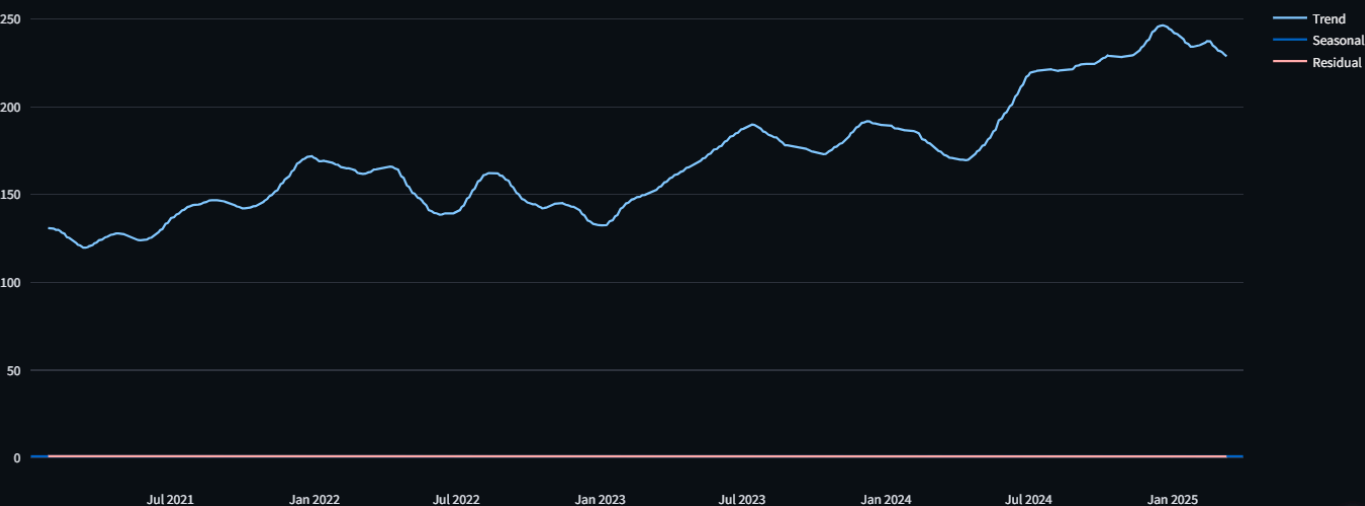
Opening vs Closing Prices Over Time

This graph compares the stock's opening and closing prices each day. A significant difference between them may indicate high volatility and investor reactions to market news.



Time Series Decomposition

Time series decomposition breaks down the stock price into trend, seasonal, and residual components. The trend shows the long-term movement, the seasonal component captures periodic patterns, and the residual reveals unexplained fluctuations.



Technical Indicators and Trend Analysis page:

Home

Basic Information

Time Series Analysis

Technical Indicators and Trend Anal...

Comparative and Statistical Analysis

Predictive Modeling

Technical Indicators & Trend Analysis

Select an Indicator Category

Price Trend & Moving Averages

Volatility & Risk Metrics

Momentum & Overbought/Oversold Indicators

Volume-Based Indicators

Support, Resistance & Channel-Based Indicators

Trade & Market Behavior Analysis

Enter Stock Symbol (e.g., AAPL, TSLA)

Fork

Price Trend & Moving Averages

Simple Moving Average (SMA)

Exponential Moving Average (EMA)

VWAP (Volume-Weighted Average Price) Over Time

MACD Indicator (Trend & Momentum)

Simple Moving Average (SMA)

Select SMA Period

5

50

200

The **Simple Moving Average (SMA)** is a commonly used indicator that smoothens price data by creating a constantly updated average price over a specific period. The line represents the average price over a given period, which helps traders identify trends and reversals in the market. A longer period SMA reacts slower to price changes, whereas a shorter period SMA is more sensitive.

Technical Indicators & Trend Analysis

Select an Indicator Category

Price Trend & Moving Averages

Volatility & Risk Metrics

Momentum & Overbought/Oversold Indicators

Volume-Based Indicators

Support, Resistance & Channel-Based Indicators

Trade & Market Behavior Analysis

Enter Stock Symbol (e.g., AAPL, TSLA)

AAPL

Start Date

2021/01/01

End Date

2025/04/02

Fork

Simple Moving Average (SMA)

Select SMA Period

5

50

200

The **Simple Moving Average (SMA)** is a commonly used indicator that smoothens price data by creating a constantly updated average price over a specific period. The line represents the average price over a given period, which helps traders identify trends and reversals in the market. A longer period SMA reacts slower to price changes, whereas a shorter period SMA is more sensitive.

Price (USD)

250

200

150

Jul 2021

Jan 2022

Jul 2022

Jan 2023

Jul 2023

Jan 2024

Jul 2024

Jan 2025

Closing Price

SMA 50

Select EMA Period

5

50

200

The **Exponential Moving Average (EMA)** is similar to the SMA but gives more weight to recent prices, making it more responsive to new information. EMAs are more useful than SMAs for short-term trading, as they react more quickly to price changes. When the price is above the EMA, the market is typically in an uptrend.

Price (USD)

250

200

150

Jul 2021

Jan 2022

Jul 2022

Jan 2023

Jul 2023

Jan 2024

Jul 2024

Jan 2025

Closing Price

EMA 50

VWAP (Volume-Weighted Average Price)

VWAP (Volume-Weighted Average Price) is an important indicator used by traders to measure the average price a security has traded at throughout the day, based on both volume and price. It's a great indicator for assessing the overall trend of a stock throughout the trading day. VWAP is commonly used to gauge the efficiency of a trade.



MACD Indicator (Trend & Momentum)

The **MACD (Moving Average Convergence Divergence)** is a trend-following momentum indicator that shows the relationship between two moving averages of a security's price. The MACD is calculated by subtracting the 26-period EMA from the 12-period EMA. The signal line is the 9-period EMA of the MACD. The MACD can help identify potential buy and sell signals.



Home

Basic Information

Time Series Analysis

Technical Indicators and Trend Anal...

Comparative and Statistical Analysis

Predictive Modeling

Technical Indicators & Trend Analysis

Select an Indicator Category

Price Trend & Moving Averages

Volatility & Risk Metrics

Momentum & Overbought/Oversold Indicators

Volume-Based Indicators

Support, Resistance & Channel-Based Indicators

Trade & Market Behavior Analysis

Enter Stock Symbol (e.g., AAPL, TSLA)

AAPL

Start Date

Volatility & Risk Metrics

Annualized Volatility

Average True Range (ATR)

Ulcer Index (Risk Indicator)

Annualized Volatility

Annualized Volatility is a measure of how much the stock price fluctuates over the course of a year. It is calculated by multiplying the standard deviation of daily returns by the square root of 252 (the number of trading days in a year). A higher volatility indicates higher risk.

Annualized Volatility: 26.72%

0.5

0.45

0.4

0.35

0.3

0.25

0.2

0.15

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Average True Range (ATR)

Average True Range (ATR) is a volatility indicator that measures market volatility by decomposing the entire range of an asset for that period. It is the average of the true ranges over a specified period (typically 14 days). ATR helps to understand price movement and potential risk.



Ulcer Index (Risk Indicator)

Ulcer Index (Risk Indicator) is a risk metric that focuses on the severity and duration of drawdowns. It calculates the square root of the average squared drawdown over a given period. The higher the Ulcer Index, the higher the risk (as it indicates a greater decline in asset value from its peak).



Home

Basic Information

Time Series Analysis

Technical Indicators and Trend Anal...

Comparative and Statistical Analysis

Predictive Modeling

Technical Indicators & Trend Analysis

Select an Indicator Category

- Price Trend & Moving Averages
- Volatility & Risk Metrics
- ☒ Momentum & Overbought/Oversold Indicators
- Volume-Based Indicators
- Support, Resistance & Channel-Based Indicators
- Trade & Market Behavior Analysis

Enter Stock Symbol (e.g., AAPL, TSLA)
AAPL

Start Date

Momentum & Overbought/Oversold Indicators

- Relative Strength Index (RSI) Chart
- Stochastic Oscillator
- Fisher Transform

Relative Strength Index (RSI) Chart

Relative Strength Index (RSI) is a momentum oscillator that measures the speed and change of price movements. RSI is typically used to identify overbought (>70) or oversold (<30) conditions in a stock. A high RSI suggests that a stock is overbought and might be due for a pullback, while a low RSI suggests that it is oversold and may be due for a reversal.

A line chart showing the Relative Strength Index (RSI) for AAPL over time. The y-axis is labeled 'Relative Strength Index (RSI)' and ranges from 0 to 100. The x-axis is labeled 'Date' and shows dates from Jul 2021 to Jan 2025. The RSI fluctuates frequently, with peaks near 100 and troughs near 0.

Stochastic Oscillator

The **Stochastic Oscillator** is a momentum indicator that compares a security's closing price to its price range over a given time period. The %K line measures the current closing price in relation to the range, and the %D line is a 3-period moving average of %K. When %K crosses above %D, it indicates upward momentum, and when %K crosses below %D, it indicates downward momentum.



Fisher Transform

The **Fisher Transform** is a technical analysis indicator that converts prices into a Gaussian normal distribution. It is designed to identify turning points in the market by measuring the deviation of the price from a defined price range. Positive values indicate upward momentum, while negative values suggest downward momentum.



Time Series Analysis

Technical Indicators and Trend Anal...

Comparative and Statistical Analysis

Predictive Modeling

Technical Indicators & Trend Analysis

Select an Indicator Category

☐ Price Trend & Moving Averages

☐ Volatility & Risk Metrics

☐ Momentum & Overbought/Oversold Indicators

☒ Volume-Based Indicators

☐ Support, Resistance & Channel-Based Indicators

☐ Trade & Market Behavior Analysis

Enter Stock Symbol (e.g., AAPL, TSLA)

AAPL

Start Date

2021/01/01

End Date

2025/04/02

Volume-Based Indicators

- On-Balance Volume (OBV)
- Intraday Intensity Index (IIX)
- Chaikin Money Flow (CMF)

On Balance Volume

OBV uses volume flow to predict changes in stock price. It is a cumulative indicator where volume is added on up days and subtracted on down days. A rising OBV indicates buying pressure, while a falling OBV indicates selling pressure.

This chart displays the On-Balance Volume (OBV) for AAPL from July 2021 to January 2025. The y-axis represents the OBV Value from -1.5B to 1.5B. The x-axis shows time with labels for Jul 2021, Jan 2022, Jul 2022, Jan 2023, Jul 2023, Jan 2024, Jul 2024, and Jan 2025. A single green line is plotted, showing the cumulative volume flow. The line shows a general upward trend with some fluctuations, indicating overall buying pressure over the period.

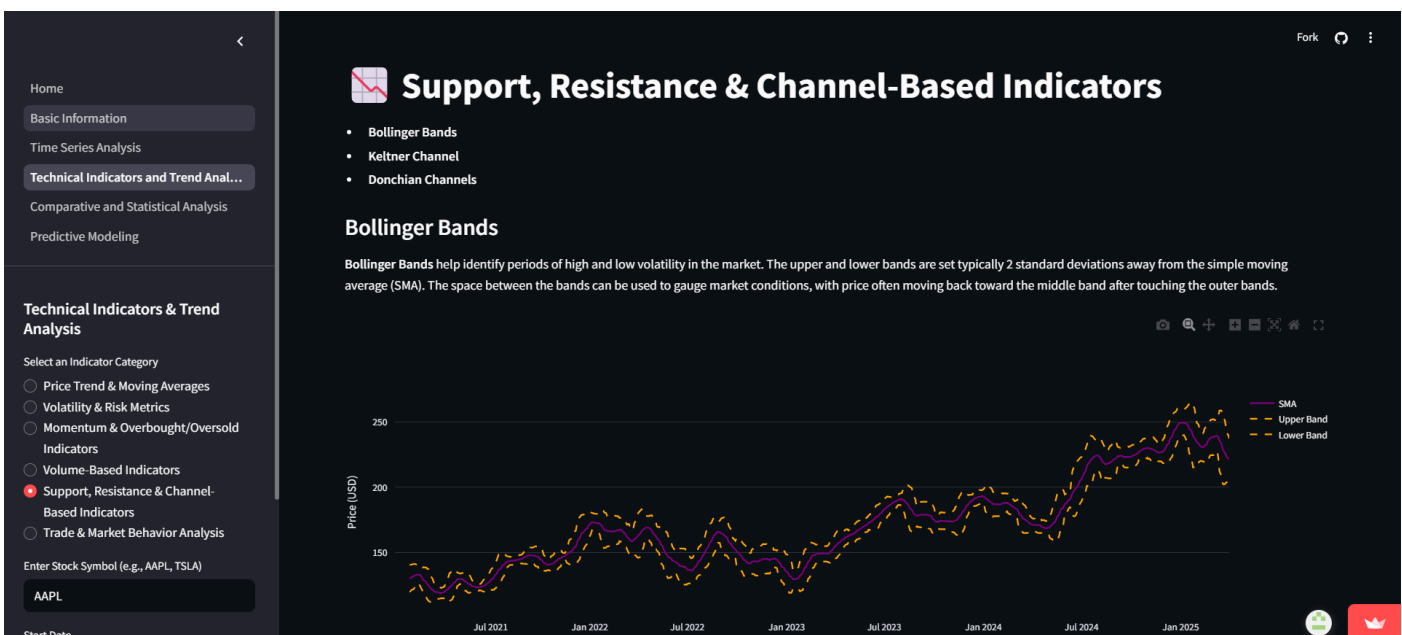
Intraday Intensity Index (IIX)

The Intraday Intensity Index measures the strength of price movement based on volume. A higher IIX value indicates stronger buying interest, while a lower value indicates weaker buying or selling activity.



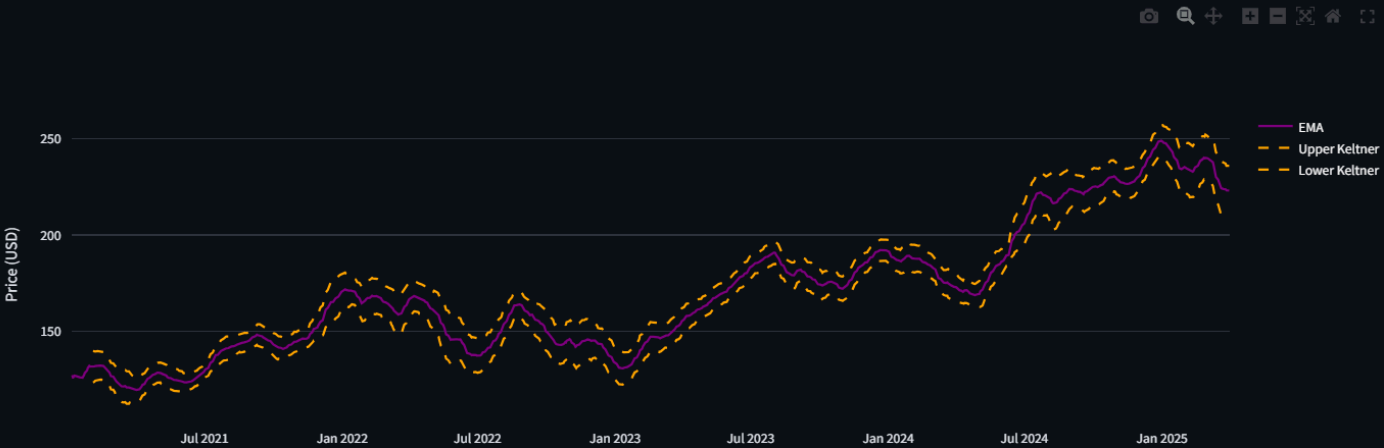
Chaikin Money Flow (CMF)

The Chaikin Money Flow indicator measures the amount of Money Flow Volume over a specific period. It combines both price and volume to evaluate buying and selling pressure. A positive CMF indicates buying pressure, while a negative CMF suggests selling pressure.



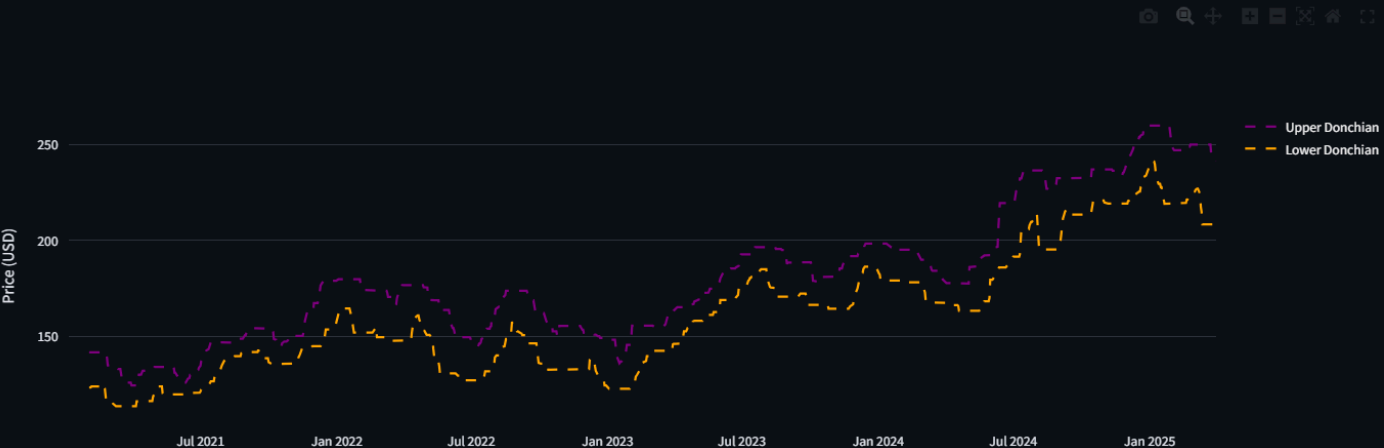
Keltner Channel

Keltner Channels are volatility-based envelopes around a central moving average. The upper and lower bands are created using the Exponential Moving Average (EMA) and the Average True Range (ATR). These channels are used to identify potential buy or sell signals based on price behavior within the channels.



Donchian Channels

Donchian Channels show the highest high and the lowest low over a set period, typically 20 periods. They are useful for identifying breakouts and volatility in the market. The upper and lower channels represent key levels of support and resistance.



Trade & Market Behavior Analysis

- Home
- Basic Information
- Time Series Analysis
- Technical Indicators and Trend Anal...
- Comparative and Statistical Analysis
- Predictive Modeling

Technical Indicators & Trend Analysis

- Select an Indicator Category
- ☐ Price Trend & Moving Averages
 - ☐ Volatility & Risk Metrics
 - ☐ Momentum & Overbought/Oversold Indicators
 - ☐ Volume-Based Indicators
 - ☐ Support, Resistance & Channel-Based Indicators
 - ☒ Trade & Market Behavior Analysis

Enter Stock Symbol (e.g., AAPL, TSLA)

AAPL

Start Date

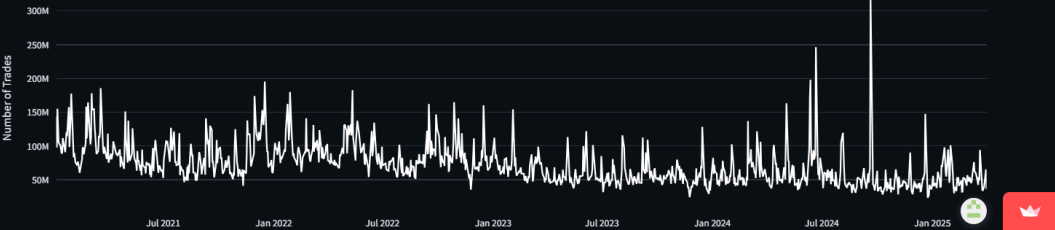


Trade & Market Behavior Analysis

- Number of Trades Over Time (Trades Analysis)
- Cumulative Return Plot
- Relative Performance Comparison
- Elder's Force Index (EFI) (Trend Strength)

Number of Trades Over Time

This indicator shows how the number of trades has evolved over time. It's used to analyze trading activity and identify periods of high or low market participation. For this, you would typically look for trade signals such as buy and sell points, and then plot the count of trades over time.



Cumulative Return Plot

This shows the cumulative return of an investment over time, which is calculated by compounding the percentage returns each day.



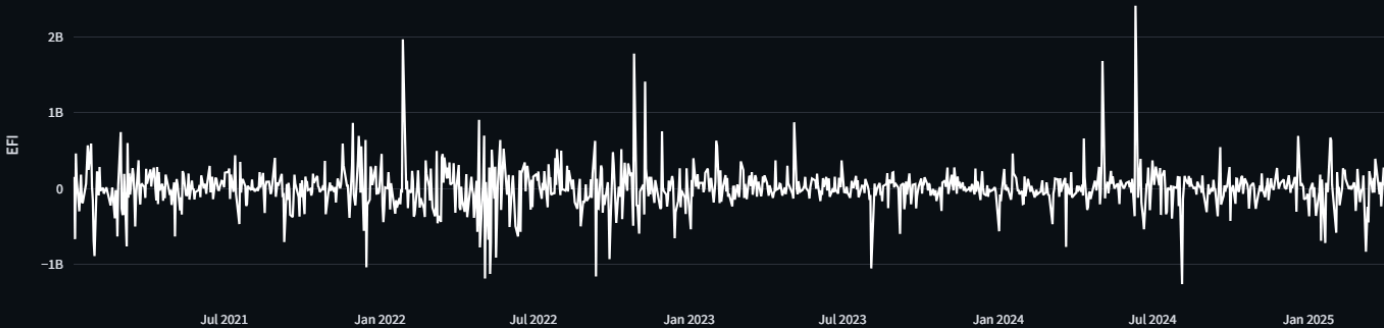
Relative Performance Comparison

This compares the performance of a stock relative to a benchmark (e.g., S&P 500). It helps to identify whether the stock is outperforming or underperforming the benchmark.

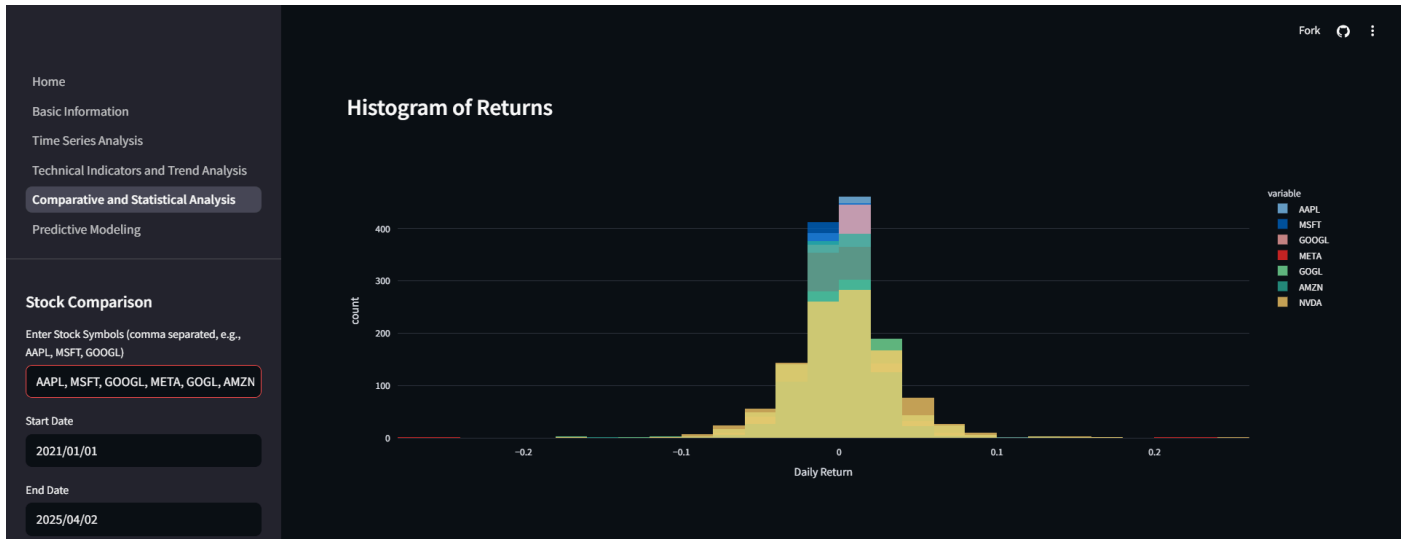
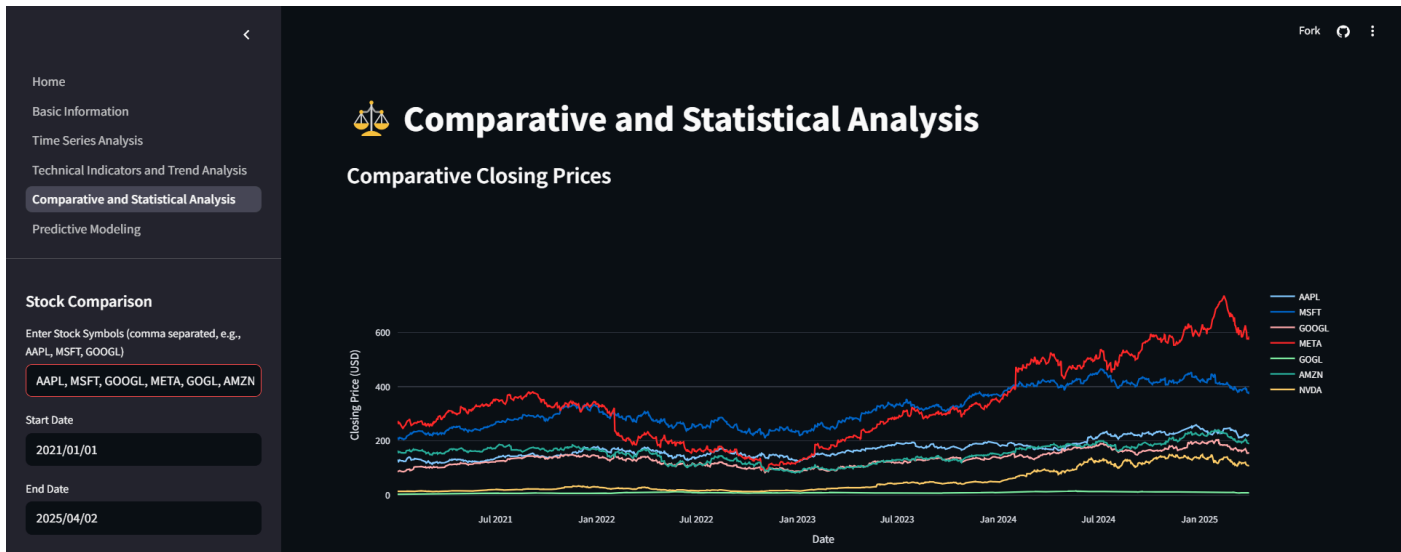
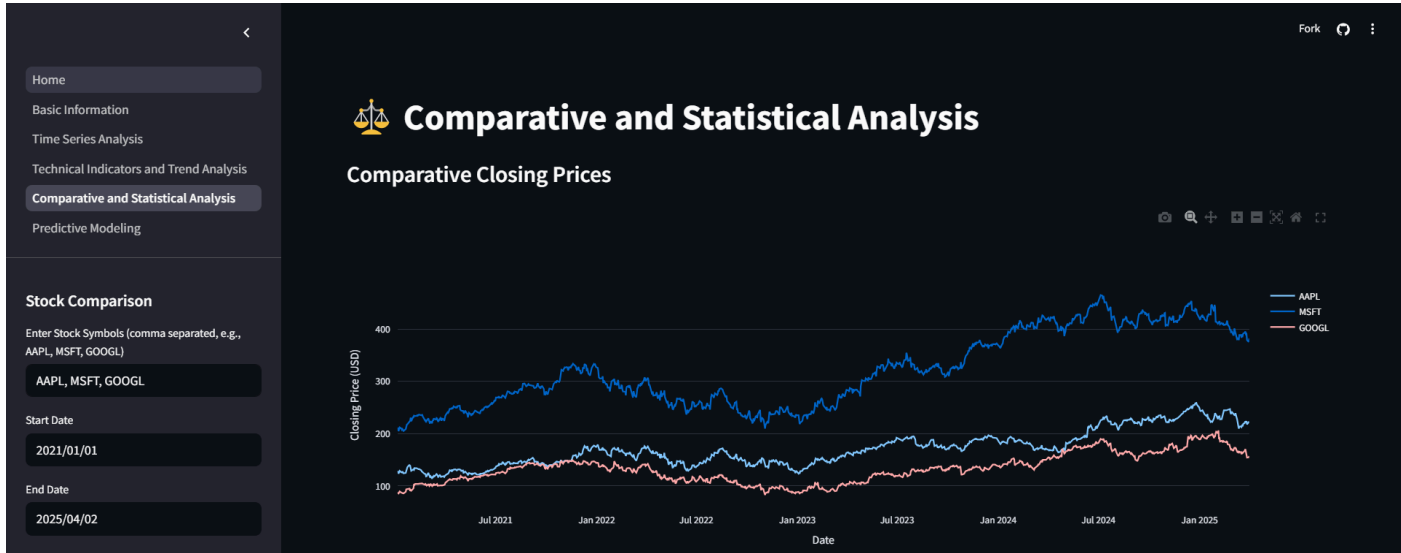


Elder's Force Index (EFI) (Trend Strength)

The Elder's Force Index (EFI) is used to measure the strength of a trend by combining price and volume. It can help identify whether a trend is strong enough to continue or likely to reverse.



Comparative and Statistical Analysis page:



Stock Predictive Modeling page:

