FINCLUB

Open Project on Technical Analysis

Technical Analysis of MACD Strategy for DJI, TSLA, and MSFT Stocks

Introduction

Technical analysis is a popular approach in financial markets that involves analyzing historical price and volume data to make informed trading decisions. One of the key indicators used in technical analysis is the Moving Average Convergence Divergence (MACD) indicator, which helps identify potential buy and sell signals in a stock's price chart. In this project, we have implemented a MACD strategy to analyze the performance of three different stocks: Dow Jones Industrial Average (DJI), Tesla Inc. (TSLA), and Microsoft Corporation (MSFT).

The MACD strategy is based on the intersection of the MACD line and the Signal (SIG) line, along with specific volume conditions. This strategy provides buy (go long) and sell (go short) signals for a particular stock. However, it is important to note that the buy/sell orders are only executed when the trading volume for the stock exceeds the average volume over the previous 10 days. If the volume conditions are not met, the intersection results in a square-off position, where no trade is executed.

The strategy relies on the variable "position" to determine the current trading status. When "position" is set to 1, it indicates a long position, -1 represents a short position, and 0 means no position is currently held or closed position to be held.

Formulas for Calculating Results

Before delving into the results for DJI, TSLA, and MSFT stocks, let's understand the formulas used to calculate the key performance metrics:

1. **Sharpe Ratio**:
   - Sharpe Ratio of Actual Returns = (Mean of Actual Returns - Risk-Free Rate) / Standard Deviation of Actual Returns
   - Sharpe Ratio of Daily Returns = (Mean of Daily Returns - Risk-Free Rate) / Standard Deviation of Daily Returns

2. **Annualized Return**:

- Annualized Return = ((Final Booksize / Initial Booksize) ^ (1 / Number of Years)) - 1

3. **Benchmark Return**:
   - Benchmark Return is a predefined benchmark return used for comparison (e.g., 2.63% annually).

4. **Number of Executed Trades**:
   - Count of executed buy and sell trades over the backtesting period.

5. **Maximum Drawdown**:
   - Maximum Drawdown = (Lowest Point - Highest Point) / Highest Point

6. **Win Ratio**:
   - Win Ratio = (Number of Positive Returns) / (Total Number of Trades)

7. **Loss-Making Trades**:
   - Count of trades with negative returns.

8. **Profit-Making Trades**:
   - Count of trades with positive returns.

9. **Largest Loss-Making Trade**:
   - The largest percentage loss among all trades.

10. **Largest Profit-Making Trade**:
    - The largest percentage profit among all trades.

Results

Now, let's dive into the results for DJI, TSLA, and MSFT stocks based on the MACD strategy:

Dow Jones Industrial Average (DJI):

- - Sharpe Ratio of Actual Returns: 0.0383
- - Sharpe Ratio of Daily Returns: 0.0344
- - Annualized Return: 2.63%
- - Benchmark Return: 2.63%
- - Number of Executed Trades: 100
- - Maximum Drawdown: -18.30%
- - Win Ratio: 0.53
- - Loss-Making Trades: 47
- - Profit-Making Trades: 53
- - Largest Loss-Making Trade: -4.96%
- - Largest Profit-Making Trade: 3.15%
- - Final Booksize: $11,387.25

The DJI stock showed a relatively low annualized return with minimal outperformance over the benchmark. The strategy executed 100 trades during the backtesting period, with a win ratio of 53%. The maximum drawdown was around 18.30%, and the largest loss-making trade was approximately 4.96%.

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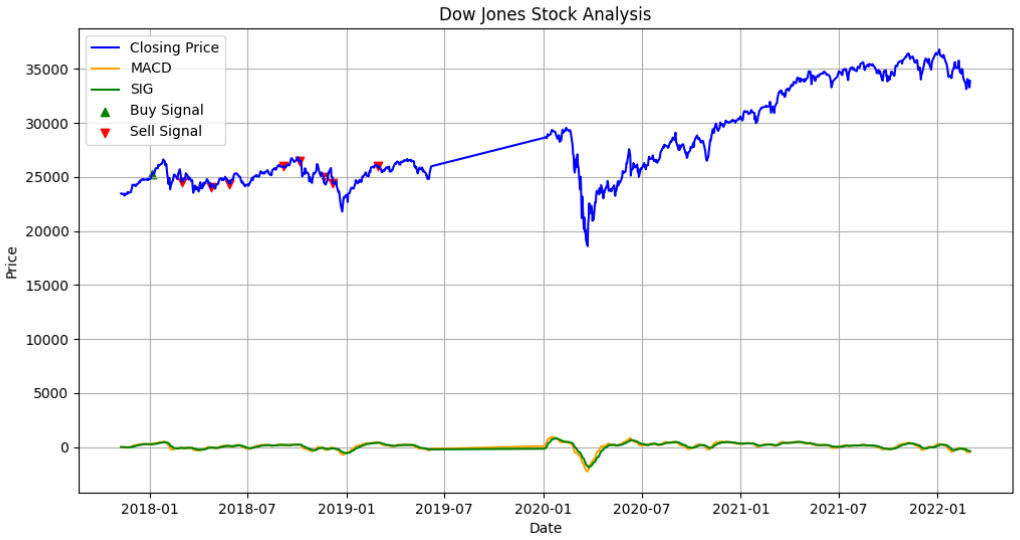

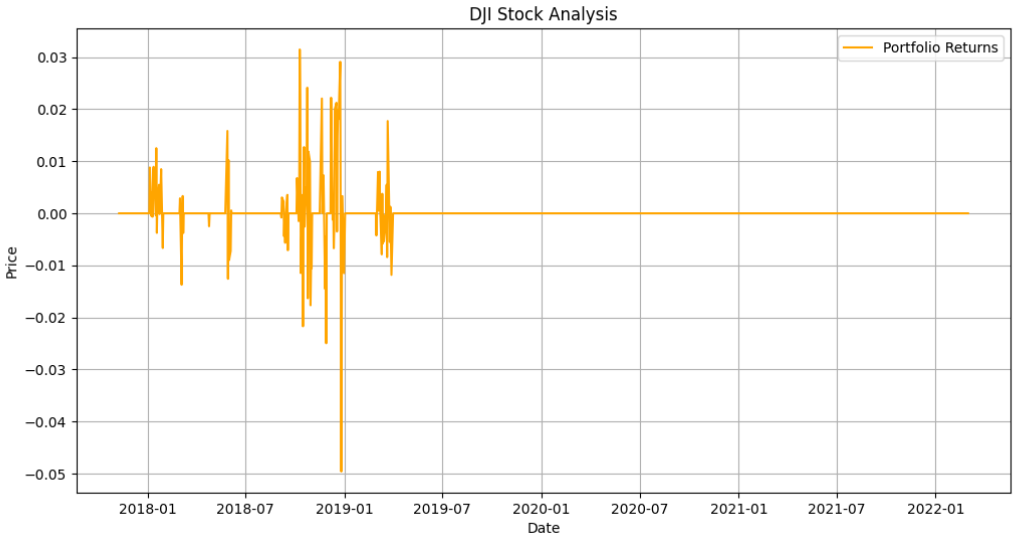
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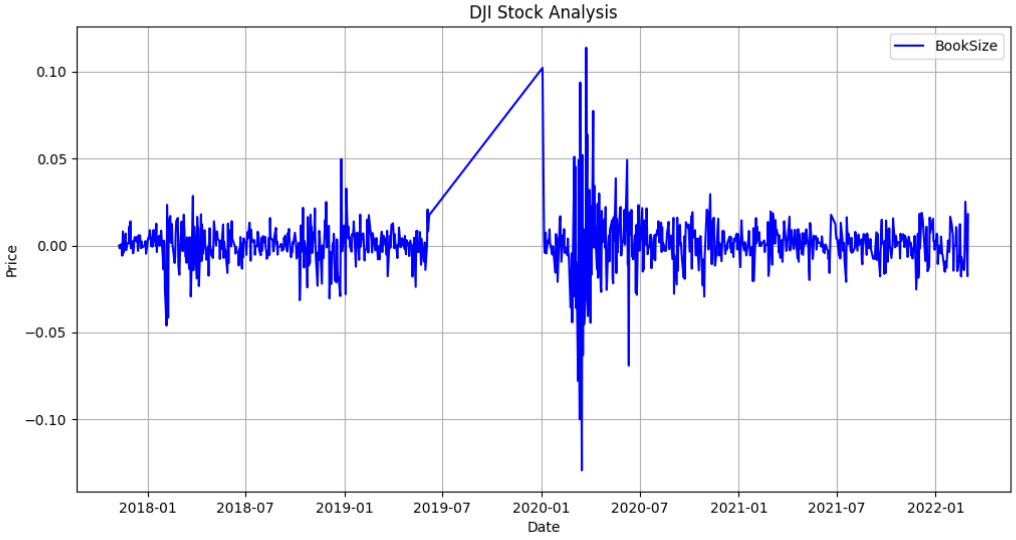
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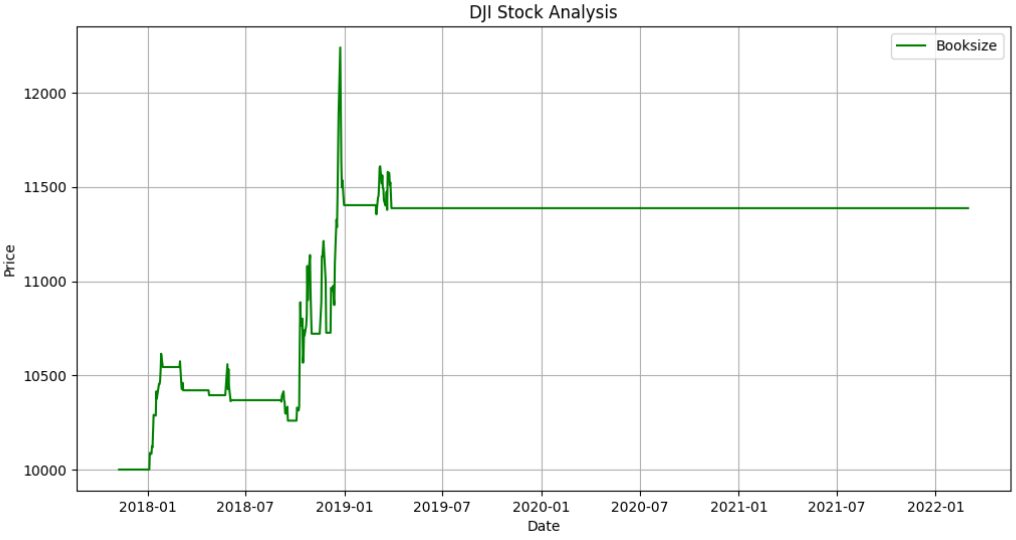
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Date
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11000
10500
10000
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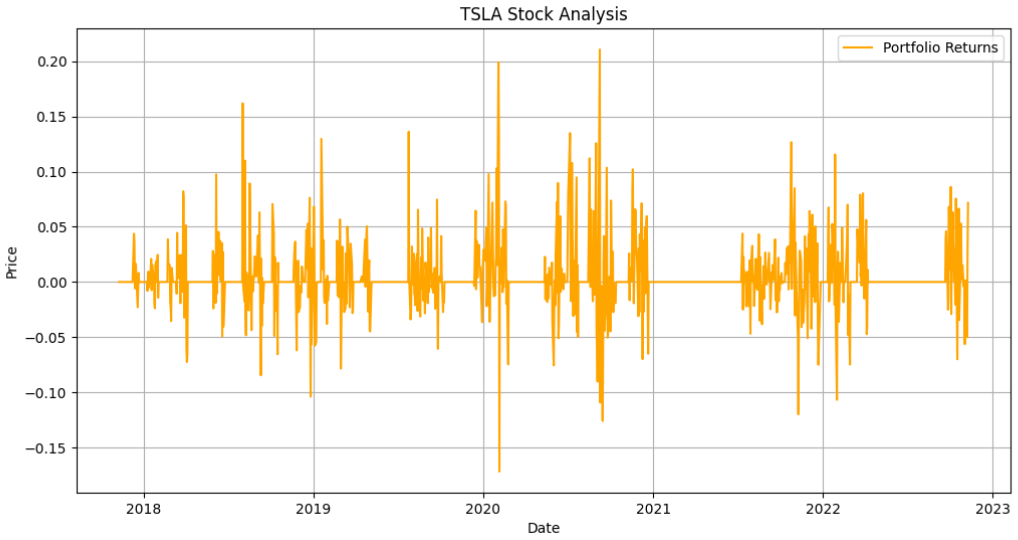
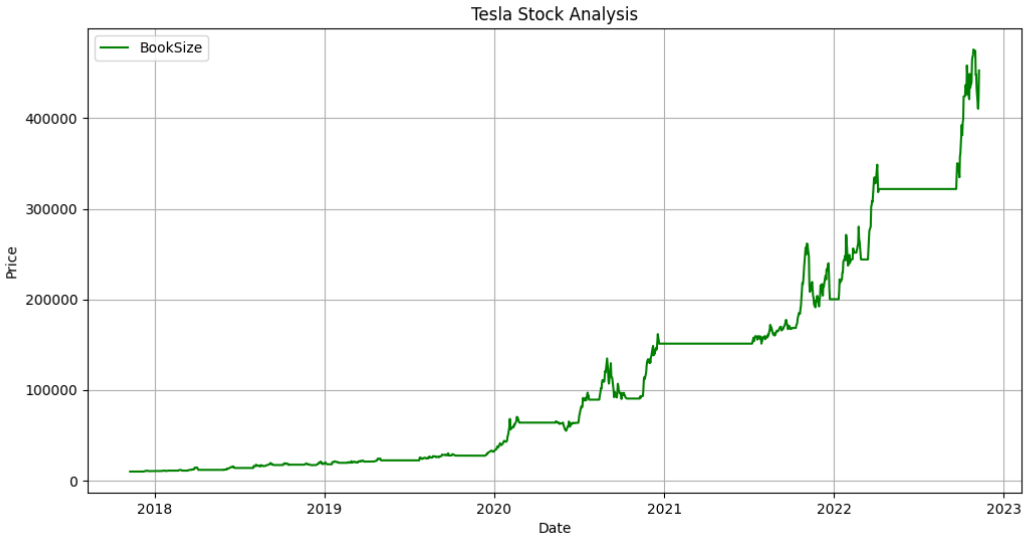
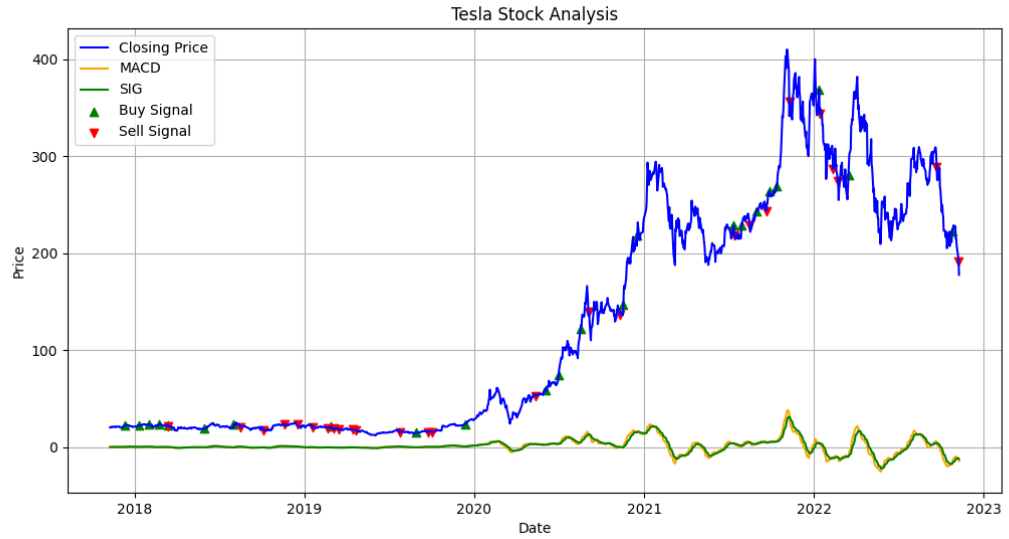
2018-07
2019-01
2019-07
2020-01
2020-07
2021-01
2021-07
2022-01

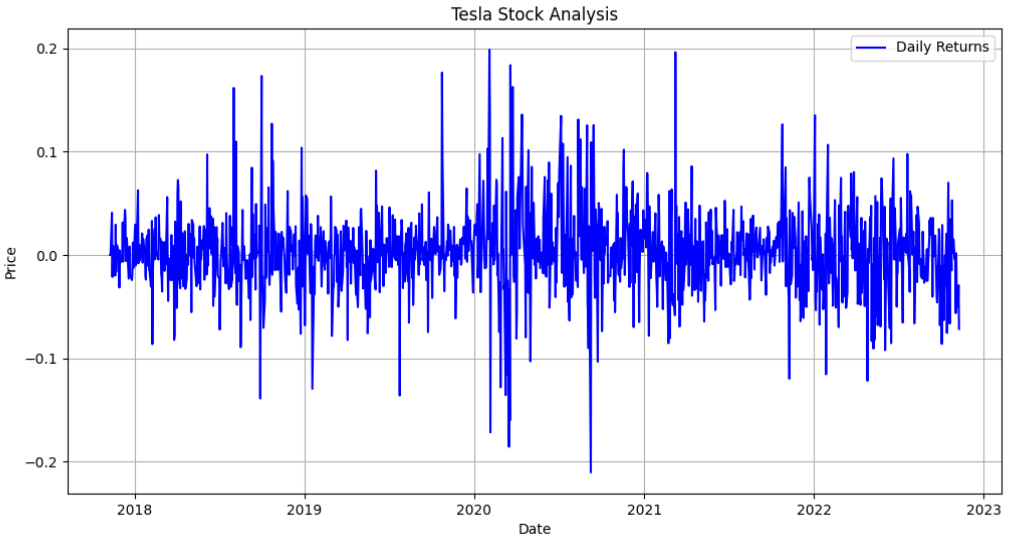
Tesla Inc. (TSLA):

- - Sharpe Ratio of Actual Returns: 0.1207
- - Sharpe Ratio of Daily Returns: 0.0628
- - Annualized Return: 114.37%
- - Benchmark Return: 2.63%
- - Number of Executed Trades: 582
- - Maximum Drawdown: -97.90%
- - Win Ratio: 0.5670
- - Loss-Making Trades: 252
- - Profit-Making Trades: 330
- - Largest Loss-Making Trade: -17.18%
- - Largest Profit-Making Trade: 21.06%
- - Final Booksize: $452,661.29





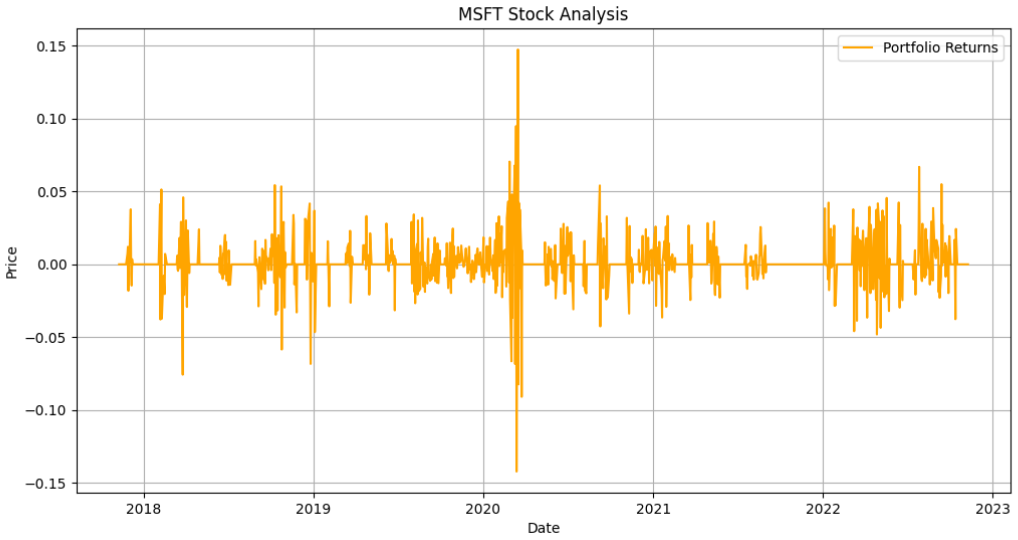


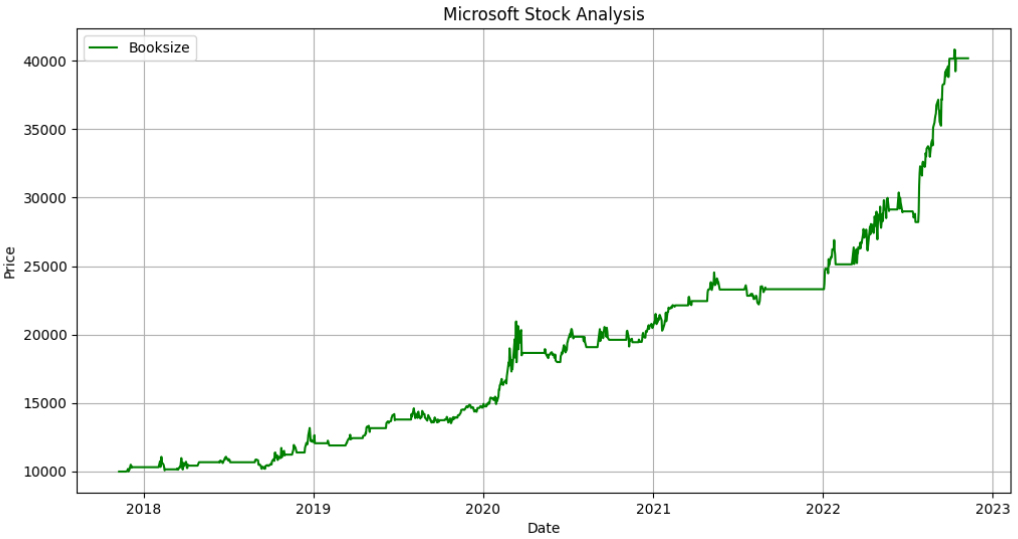


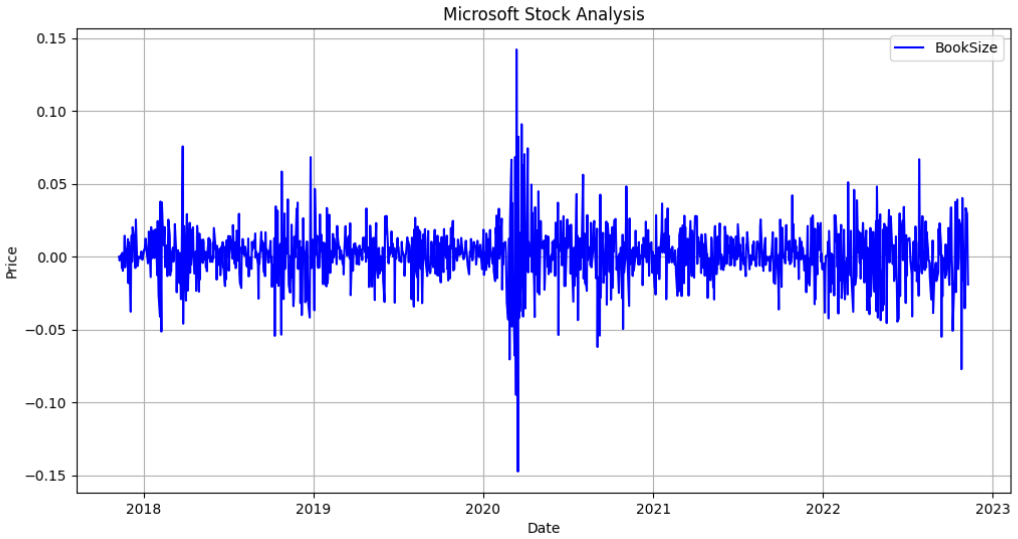
TSLA stock exhibited remarkable performance with a high annualized return of 114.37%. The strategy executed 582 trades, with a win ratio of 56.70%. However, TSLA also experienced a significant maximum drawdown of approximately 97.90%, highlighting the inherent risk associated with this strategy.

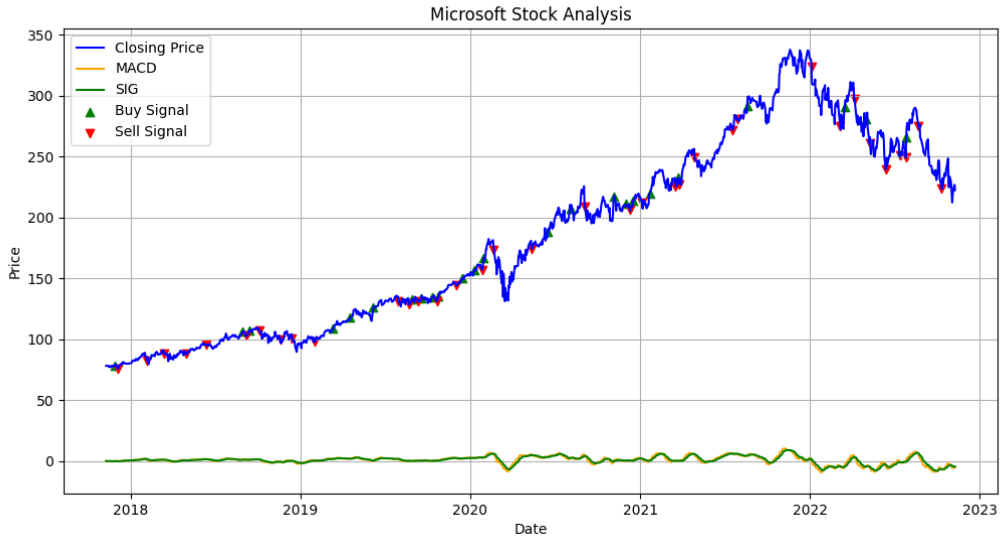
Microsoft Corporation (MSFT):

- - Sharpe Ratio of Actual Returns: 0.0802
- - Sharpe Ratio of Daily Returns: 0.0527
- - Annualized Return: 32.06%
- - Benchmark Return: 2.63%
- - Number of Executed Trades: 623
- - Maximum Drawdown: -75.50%
- - Win Ratio: 0.5684
- - Loss-Making Trades: 268
- - Profit-Making Trades: 353
- - Largest Loss-Making Trade: -14.22%
- - Largest Profit-Making Trade: 14.74%
- - Final Booksize: $40,166.46









MSFT stock delivered a solid annualized return of 32.06%, outperforming the benchmark. The strategy executed 623 trades, with a win ratio of 56.84%. MSFT experienced a maximum drawdown of 75.50%, indicating some significant fluctuations in book size during the backtesting period.

Insights and Strategy Development

The results of the MACD strategy for DJI, TSLA, and MSFT stocks provide valuable insights into the performance and risk associated with this particular trading approach. Here are some key takeaways and considerations for further strategy development:

1. **High Variability in Results**: The strategy's performance varies significantly across the three stocks. TSLA exhibited the highest annualized return, but it also had the largest maximum drawdown. DJI, on the other hand, had a more conservative performance, with a lower annualized return and a smaller drawdown. MSFT struck a balance between the two, offering a relatively strong return with a moderate drawdown.

2. **Risk Management**: The high maximum drawdown in the TSLA strategy suggests that risk management is crucial. Further development of the strategy could include mechanisms to limit losses during adverse market conditions, such as implementing stop-loss orders or dynamic position sizing.

3. **Benchmark Comparison**: The benchmark return used in this analysis was a fixed value (2.63%). In practice, benchmark selection can have a significant impact on strategy evaluation. Consider using a benchmark that closely represents the asset class or market you are trading to make a more meaningful comparison.

4. **Portfolio Diversification**: Instead of focusing on a single stock, diversifying the portfolio by including multiple assets can help spread risk. It's important to analyze how the strategy performs in a diversified portfolio context.

5. **Market Conditions**: The MACD strategy's performance can be influenced by market conditions, economic events, and the stock's specific behavior. Periodic monitoring and adaptation to changing conditions are

Certainly, here are three key improvements to consider for the MACD trading strategy:

1. **Advanced Risk Management:** Enhance the risk management aspect of the strategy by implementing dynamic stop-loss and take-profit levels. These levels should be based on factors like historical volatility, recent price movements, and the stock's specific behavior. This can help protect the portfolio from large losses and lock in profits when favorable conditions are met.

2. **Machine Learning Integration:** Consider incorporating machine learning models to improve signal accuracy. Machine learning algorithms can analyze a broader range of data and potentially identify patterns and trends that may not be apparent through traditional technical analysis alone. By combining MACD signals with machine learning predictions, you can enhance the strategy's precision.

3. **Multi-Asset Analysis:** Extend the strategy to analyze and trade multiple assets simultaneously. Diversifying the portfolio across different stocks, sectors, or asset classes can reduce risk and enhance overall returns. Implementing a multi-asset approach requires careful portfolio allocation and risk management strategies tailored to each asset's characteristics

Python Files and How to Run the MACD Indicator

In this section, we will describe the three Python files involved in this project and provide instructions on how to run the MACD indicator for your own analysis.

1. Main.py

Description:
- Main.py is the core script where you can gather financial data, calculate MACD and trading signals, and visualize the results.
- It uses the yfinance library to fetch historical stock data, and calculates Exponential Moving Averages (EMA), MACD, and trading signals.

How to Run:
- To run Main.py, you need to install the required libraries. You can use pip to install yfinance and matplotlib.

```python
pip install yfinance
pip install matplotlib
```

- After installing the necessary libraries, you can run Main.py using Python. Ensure you have the required dependencies and follow these steps:
  - Open a terminal or command prompt.
  - Navigate to the directory where Main.py is located.
  - Run the script using the following command:

```python
python Main.py
```

- The script will fetch financial data, calculate the MACD and trading signals, and display a plot showing buy and sell signals on the stock's price chart

2. Results.py

Description:
- Results.py is responsible for calculating key performance metrics such as Sharpe ratio, annualized return, benchmark return, the number of executed trades, maximum drawdown, win ratio, loss-making trades, largest loss-making trade, largest profit-making trade, and final booksize.
- It also calculates daily returns and portfolio returns based on the trading signals.

How to Run:
- Results.py is automatically imported and executed within the Main.py script. You don't need to run Results.py separately. It is called from Main.py to perform the calculations.

3. Plotting.py

Description:

Plotting.py is used to create visual representations of the results, including closing price vs. date, portfolio returns vs. date, and other relevant plots.

How to Run:

Similar to Results.py, Plotting.py is called from Main.py to create the plots. You don't need to run Plotting.py separately. It is automatically executed when you run Main.py.

Instructions for Running the MACD Indicator:

1. Ensure you have Python installed on your system. If not, you can download and install Python from the official website (https://www.python.org/downloads/).

2. Install the required libraries using pip, as mentioned in the "How to Run" section for Main.py. Make sure to install yfinance and matplotlib.

3. Download or create the Main.py, Results.py, and Plotting.py files in the same directory.

4. Open a terminal or command prompt and navigate to the directory where these Python files are located.

5. Run the Main.py script using the following command:
   ```python
   python Main.py
   ```

6. The Main.py script will fetch historical stock data, calculate the MACD and trading signals, and display the plots of buy and sell signals on the stock's price chart.

Notes:
- Ensure that you have an internet connection to fetch data from Yahoo Finance using yfinance.
- Make sure the required libraries and dependencies are correctly installed to avoid any errors.

By following these instructions, you can easily run the MACD indicator and analyze the results for different stocks. The provided Python files automate the process and make it convenient for users to evaluate the MACD trading strategy.