STOCK MARKET ANALYSIS OF APPLE.Inc AAPL

REPORT

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1. Introduction

The objective of this project is to analyse the historical stock prices of Apple Inc. (AAPL) to identify trends, generate trading signals, and evaluate a moving average crossover strategy. This analysis involves data cleaning, exploratory data analysis (EDA), time series analysis, and the development of a trading strategy based on moving averages.

2. Data Description

The dataset used in this analysis includes historical stock prices for Apple Inc. (AAPL) obtained from Yahoo Finance. The dataset contains the following columns:

- **Date:** The date of the stock data.
- **Open:** The opening price of the stock on that day.
- **High:** The highest price of the stock on that day.
- **Low:** The lowest price of the stock on that day.
- **Close:** The closing price of the stock on that day.
- **Adj Close:** The adjusted closing price of the stock on that day.
- **Volume:** The number of shares traded on that day.

The dataset covers daily stock prices over several years.

3. Data Cleaning

The data cleaning process involved:

- **Handling Missing Values:** Missing values were forward filled to ensure continuity in the data.
- **Date Conversion**: The 'Date' column was converted to datetime format to facilitate time series analysis.
- **Data Type Verification:** Ensured that numerical columns are in the correct format and free from inconsistencies.
- **Duplicate Removal:** Checked and removed any duplicate rows to maintain data integrity.

The cleaned dataset is ready for analysis with no missing values or duplicates.

4. Exploratory Data Analysis (EDA)

4.1 Key Findings:

- **Summary Statistics:** The dataset's statistics reveal average values, standard deviations, and ranges for stock prices and trading volume.
- **Price Trends:** The closing prices generally exhibit an upward trend over time, with notable fluctuations reflecting market volatility.
- **Daily Returns and Volatility:** Daily returns, calculated as percentage changes in closing prices, and rolling standard deviation indicate periods of high and low volatility.

4.2 Visualizations:

- **Price Trends:** A plot of closing prices over time showed distinct upward and downward trends.
- **Daily Returns:** A histogram of daily returns highlighted the distribution and variability of returns.
- **Volatility:** A plot of rolling standard deviation visualized periods of increased or decreased volatility.

5. Time Series Analysis

5.1 Moving Averages and EMAs:

- **Simple Moving Averages (SMA):** Calculated 20-day and 50-day SMAs to analyse short-term and long-term trends.
- **Exponential Moving Averages (EMA):** Calculated 20-day and 50-day EMAs to give more weight to recent prices and identify trends.

5.2 Buy and Sell Signals:

- **Buy Signal:** Generated when the 20-day SMA crossed above the 50-day SMA.
- **Sell Signal:** Generated when the 20-day SMA crossed below the 50-day SMA.

5.3 Visualizations:

- Plots showing closing prices along with SMAs and EMAs, with buy and sell signals highlighted.

6. Trading Strategy

6.1 Explanation:

The moving average crossover strategy involves using two moving averages to generate trading signals:

- **Buy Signal:** Occurs when the short-term SMA (20-day) crosses above the long-term SMA (50-day).
- **Sell Signal:** Occurs when the short-term SMA crosses below the long-term SMA.

6.2 Signals Identified:

- The strategy successfully identified several buy and sell signals during trending periods. However, it was less effective during sideways or low-volatility periods, where false signals were more frequent.

7. Recommendations

7.1 Suggestions for Improving the Strategy:

- **Incorporate Additional Indicators:** Use indicators like RSI or Bollinger Bands to confirm signals and filter out false signals.
- **Adjust Moving Average Lengths:** Experiment with different SMA periods to optimize for varying market conditions.
- **Implement Stop-Loss and Take-Profit Levels:** Add risk management features to protect against large losses and secure profits.

7.2 Ideas for Further Analysis:

- **Explore Machine Learning Techniques:** Use predictive modelling and sentiment analysis to enhance the strategy.
- **Analyse Multiple Stocks:** Extend the analysis to a diversified portfolio to identify trends and opportunities across different stocks.
- **Implement a Trend-Following Strategy:** Use trend strength indicators to avoid trades during weak trends.

8. Appendix

Code Snippets for Key Parts of the Analysis

Data Cleaning

```
import pandas as pd

df = pd.read_csv('C:/Users/KRAVEN/Documents/New folder/AAPL.csv')

df.fillna(method='ffill', inplace=True)

df['Date'] = pd.to_datetime(df['Date'])

df.set_index('Date', inplace=True)

df.drop_duplicates(inplace=True)
```

Moving Averages Calculation

```
df['SMA_20'] = df['Close'].rolling(window=20).mean()
df['SMA_50'] = df['Close'].rolling(window=50).mean()
df['EMA_20'] = df['Close'].ewm(span=20, adjust=False).mean()
df['EMA_50'] = df['Close'].ewm(span=50, adjust=False).mean()
```

Identifying Buy and Sell Signals

```
import numpy as np
df['Signal'] = np.where(df['SMA_20'] > df['SMA_50'], 1, 0)
df['Position'] = df['Signal'].diff()
df['Buy_Signal_Price'] = np.where(df['Position'] == 1, df['Close'], np.nan)
df['Sell_Signal_Price'] = np.where(df['Position'] == -1, df['Close'], np.nan)
```

Volatility Analysis

```
df['Volatility'] = df['Close'].rolling(window=20).std()
```

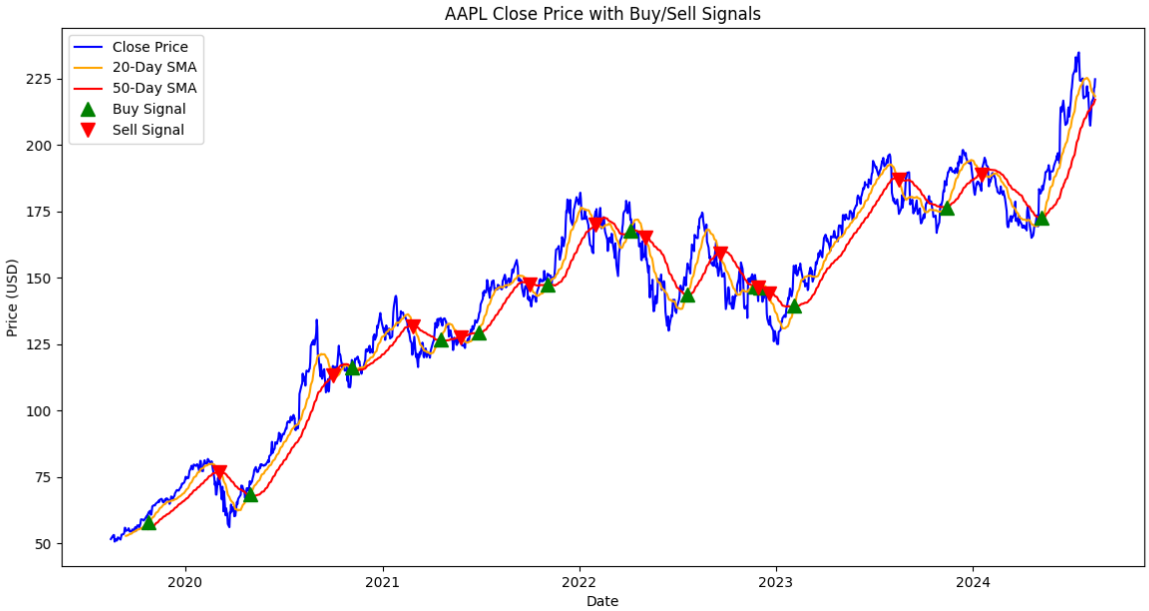
Plotting the Results

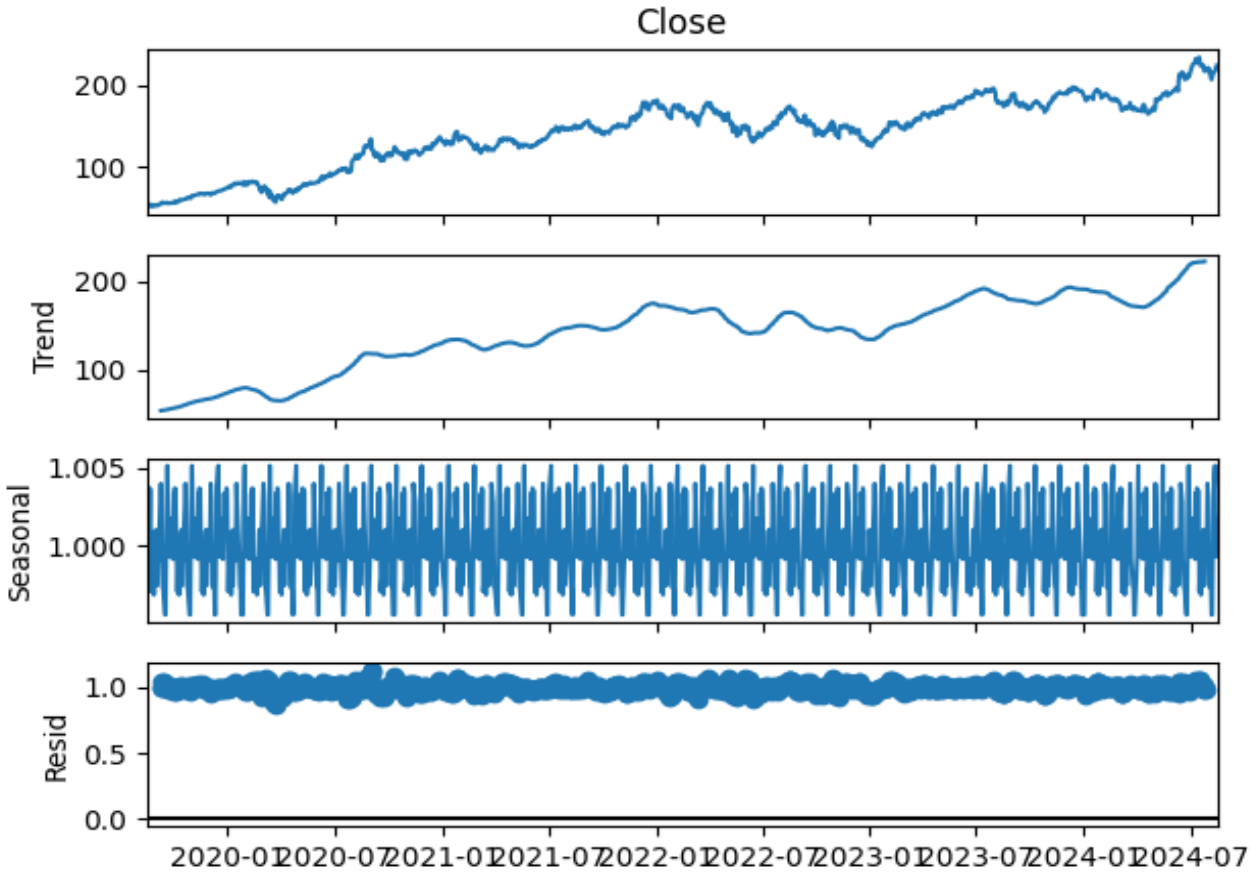
```
import matplotlib.pyplot as plt
plt.figure(figsize=(14,7))
plt.plot(df['Close'], label='Close Price', alpha=0.5)
plt.plot(df['SMA_20'], label='SMA 20', alpha=0.75)
plt.plot(df['SMA_50'], label='SMA 50', alpha=0.75)
```

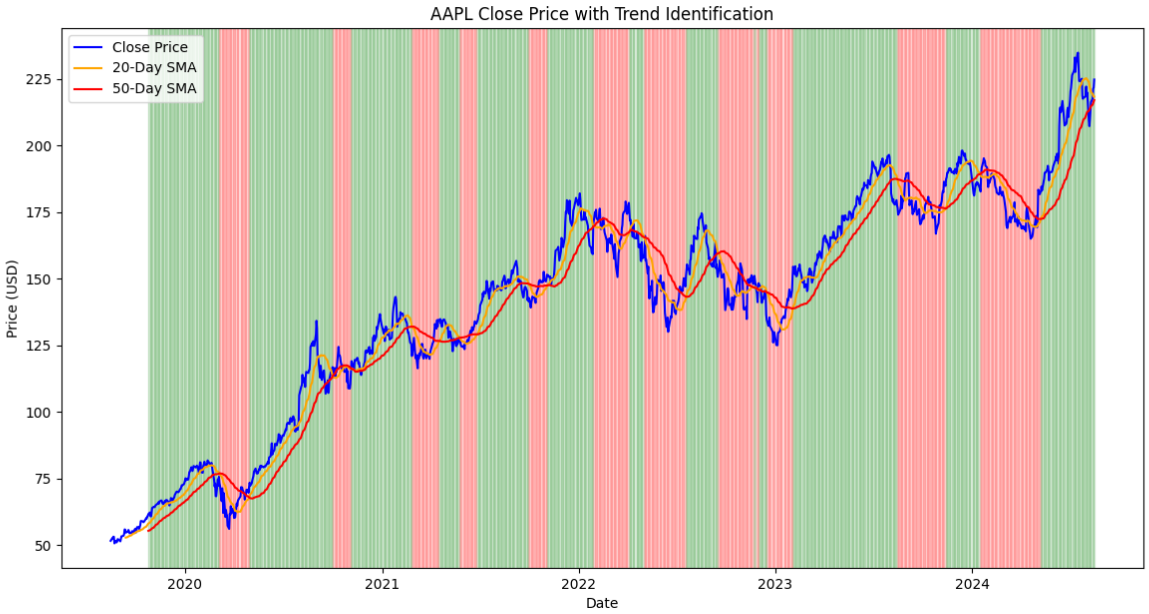
```
plt.scatter(df.index, df['Buy_Signal_Price'], label='Buy Signal', marker='^', color='green')
plt.scatter(df.index, df['Sell_Signal_Price'], label='Sell Signal', marker='v', color='red')
plt.title('AAPL Stock Price with Buy and Sell Signals')
plt.xlabel('Date')
plt.ylabel('Price')
plt.legend(loc='best')
plt.show()

plt.figure(figsize=(14,7))
plt.plot(df['Volatility'], label='Volatility', color='orange')
plt.title('AAPL Stock Volatility')
plt.xlabel('Date')
plt.ylabel('Rolling Standard Deviation')
plt.legend(loc='best')
plt.show()
```

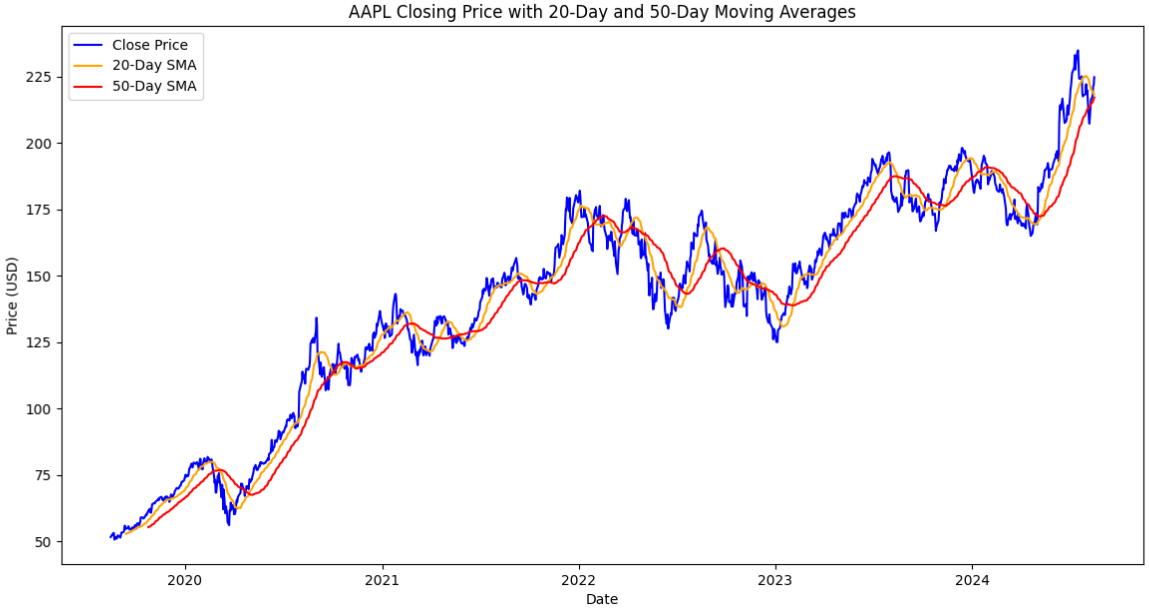
Additional Charts or Data Tables

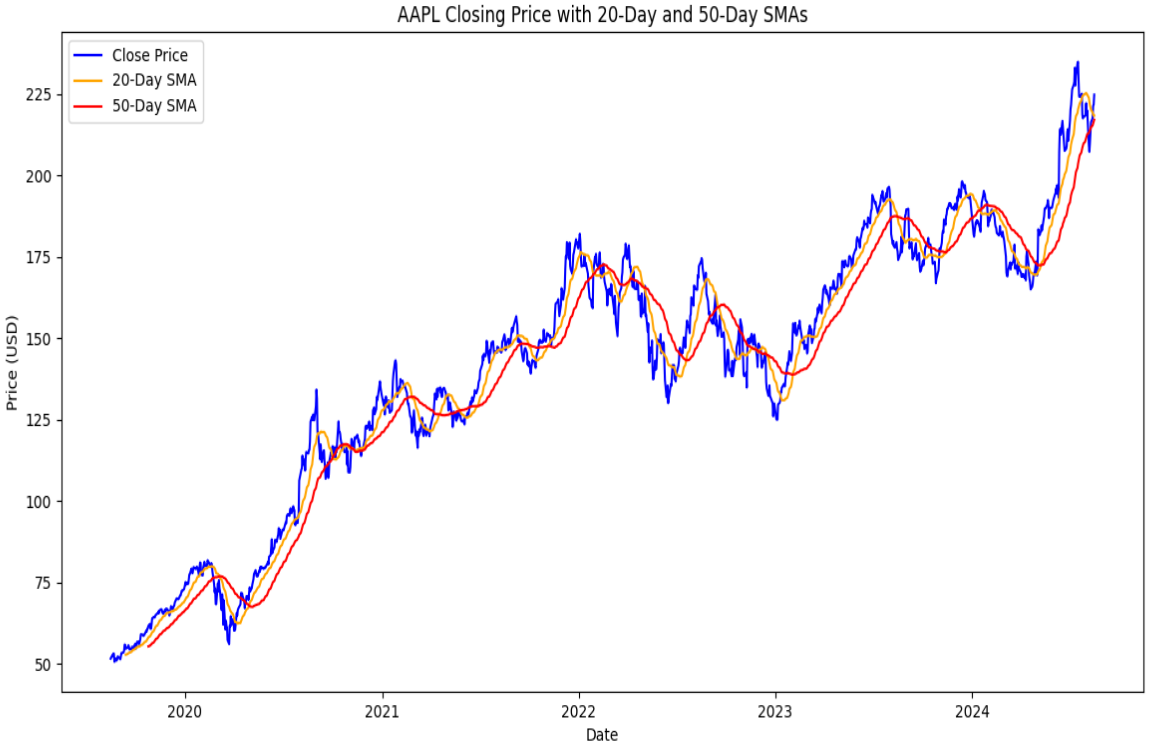
AAPL Stock Price with Moving Averages and Trading Signals:

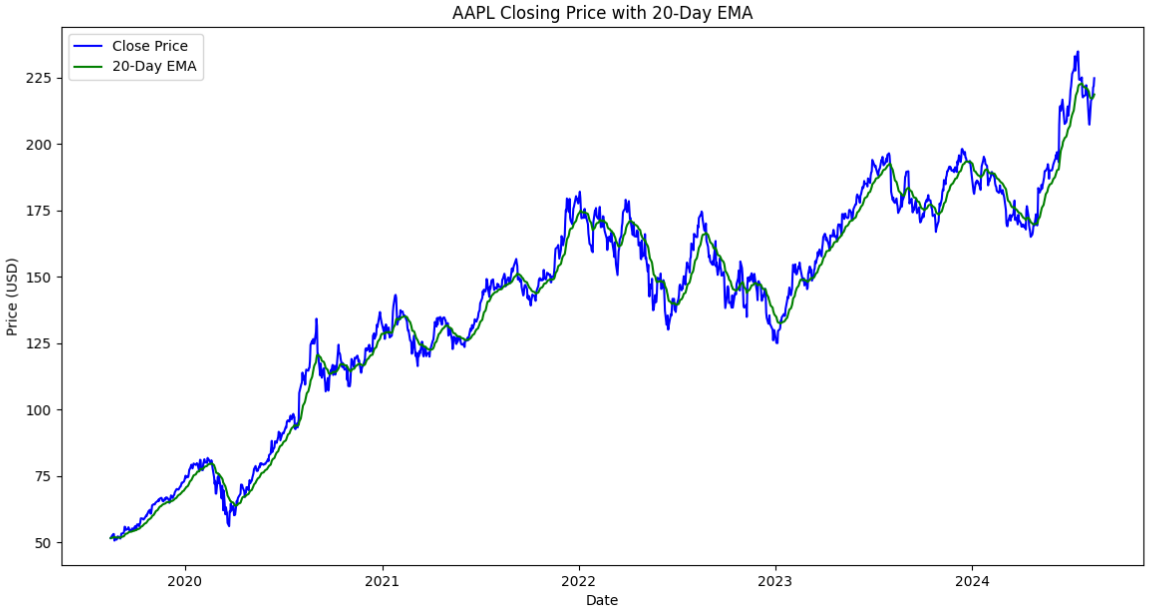


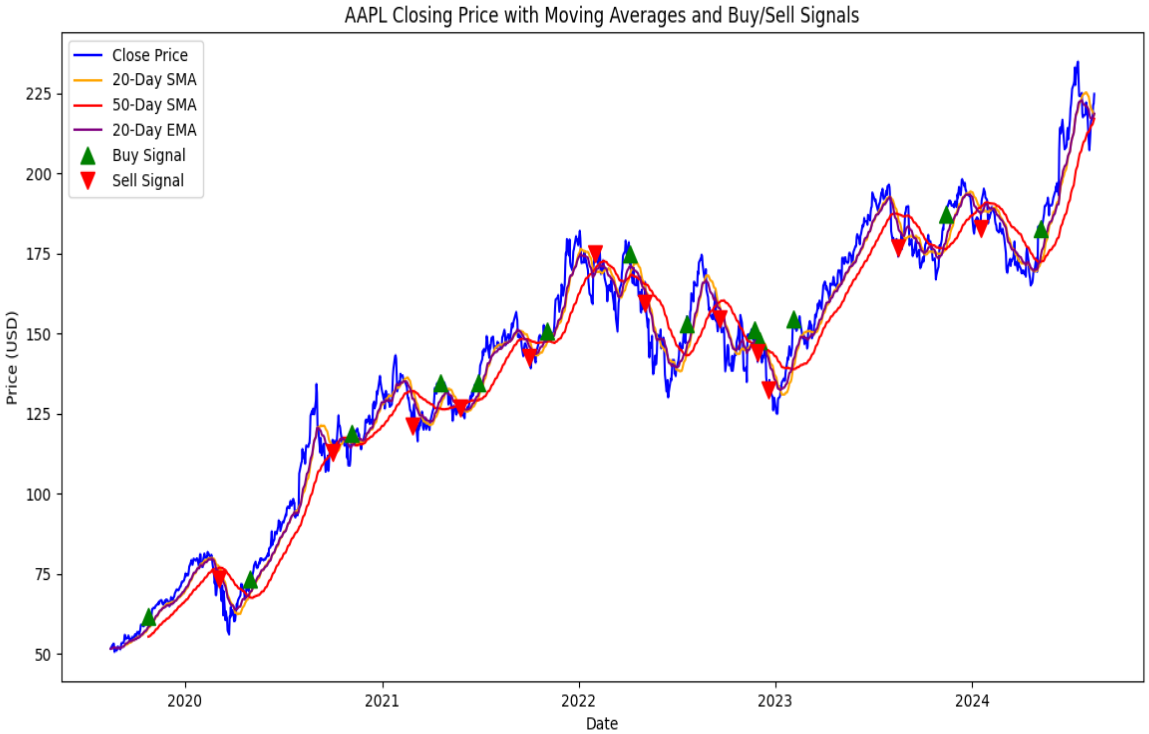

Close
200
100
Trend
200
100
Seasonal
1.005
1.000
Resid
1.0
0.5
0.0
2020-01
2020-07
2021-01
2021-07
2022-01
2022-07
2023-01
2023-07
2024-01
2024-07

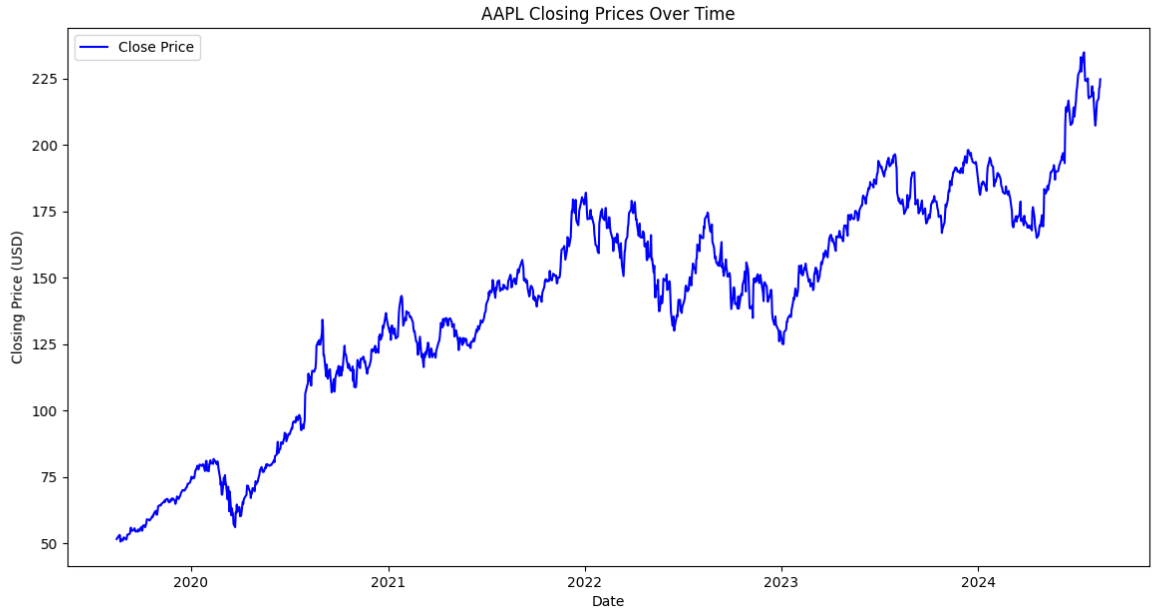

AAPL Close Price with Trend Identification
Close Price
20-Day SMA
50-Day SMA
Price (USD)
225
200
175
150
125
100
75
50
2020
2021
2022
2023
2024
Date


AAPL Closing Price with 20-Day and 50-Day Moving Averages
Close Price
20-Day SMA
50-Day SMA
Price (USD)
225
200
175
150
125
100
75
50
2020
2021
2022
2023
2024
Date

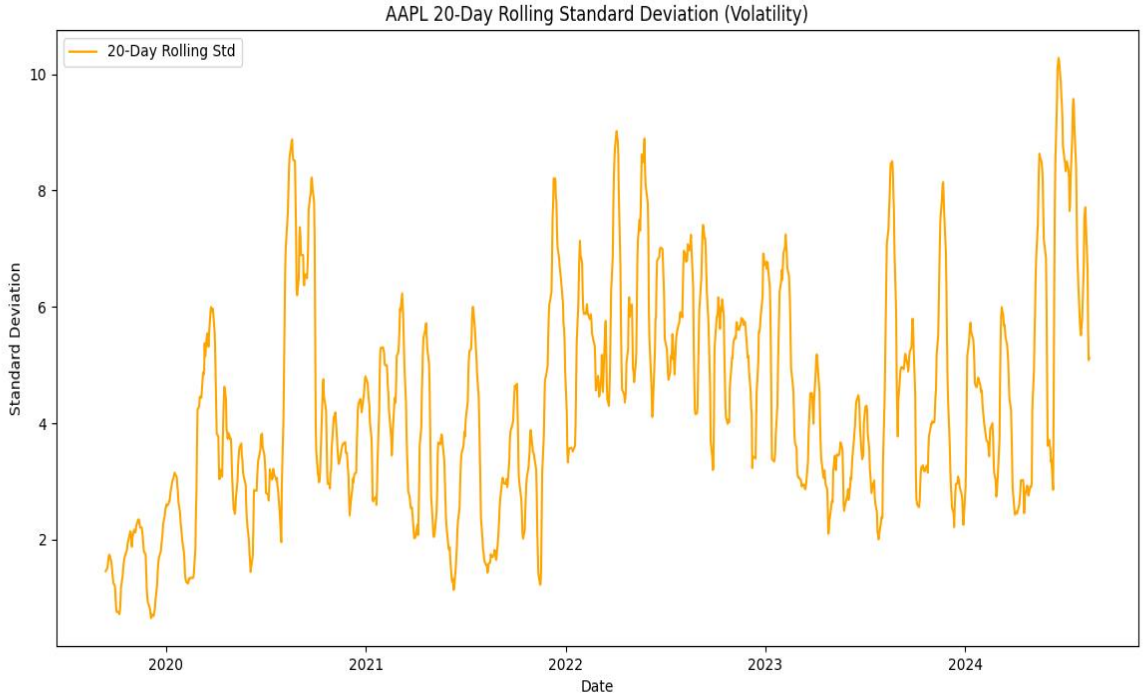

AAPL Closing Price with 20-Day and 50-Day SMAs
Close Price
20-Day SMA
50-Day SMA
Price (USD)
225
200
175
150
125
100
75
50
2020
2021
2022
2023
2024
Date

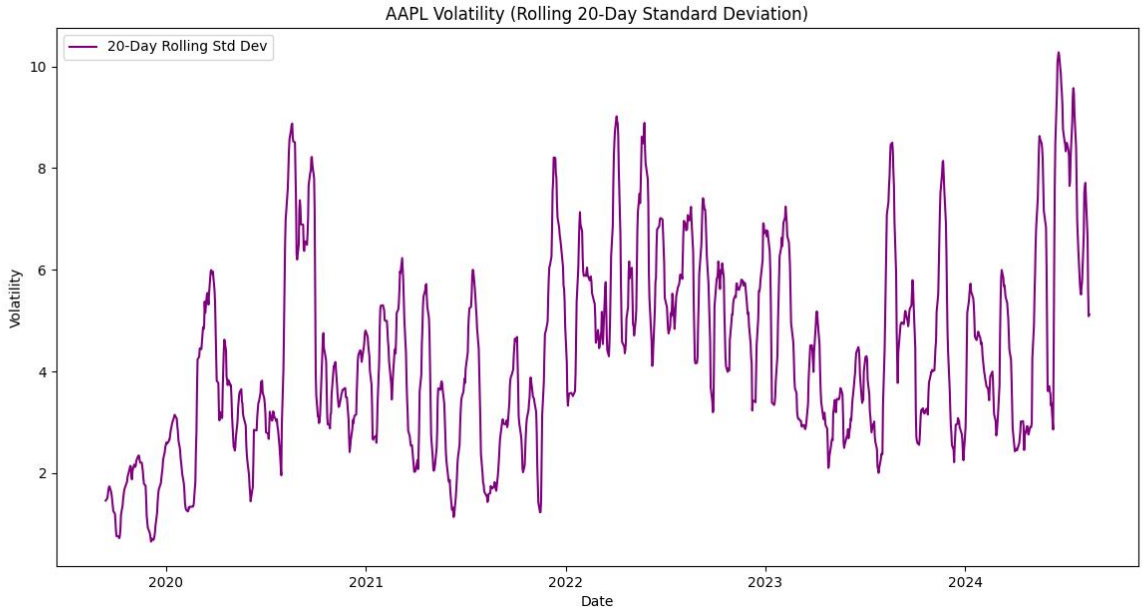

AAPL Closing Price with 20-Day EMA
Close Price
20-Day EMA
Price (USD)
225
200
175
150
125
100
75
50
2020
2021
2022
2023
2024
Date


AAPL Closing Price with Moving Averages and Buy/Sell Signals
Close Price
20-Day SMA
50-Day SMA
20-Day EMA
Buy Signal
Sell Signal
Price (USD)
225
200
175
150
125
100
75
50
2020
2021
2022
2023
2024
Date



AAPL Stock Volatility Analysis





Summary Statistics Table:

Statistic	Open	High	Low	Close	Adj Close	Volume
Count	1258	1258	1258	1258	1258	1258
Mean	141.04	142.63	139.56	141.17	139.42	94889579.99
Std Dev	41.81	42.12	41.51	41.82	42.22	51992236.42
Min	51.03	51.43	50.25	50.66	49.02	24048300.00
25th Percentile	120.08	121.50	118.66	120.10	117.74	60446700.00
50th Percentile	147.25	149.05	145.81	147.47	145.65	81345450.00
75th Percentile	172.33	173.99	170.92	172.69	171.25	111927500.00
Max	236.48	237.23	233.09	234.82	234.55	426510000.00

This report summarizes the analysis performed on AAPL's stock data, highlights the effectiveness of the moving average crossover strategy, and provides recommendations for further improvements and analyses.