MSFT Stock Forecasting Report: ARIMA vs LSTM

1. Time Series Analysis.

We retrieved historical daily stock prices of Microsoft (MSFT) using Yahoo Finance with a span of 5+ years. Exploratory analysis includes rolling averages, seasonal decomposition, and statistical tests for stationarity.

Initial ADF Test:

ADF Statistic: 0.1764

p-value: 0.9709

→the series is non-stationary.

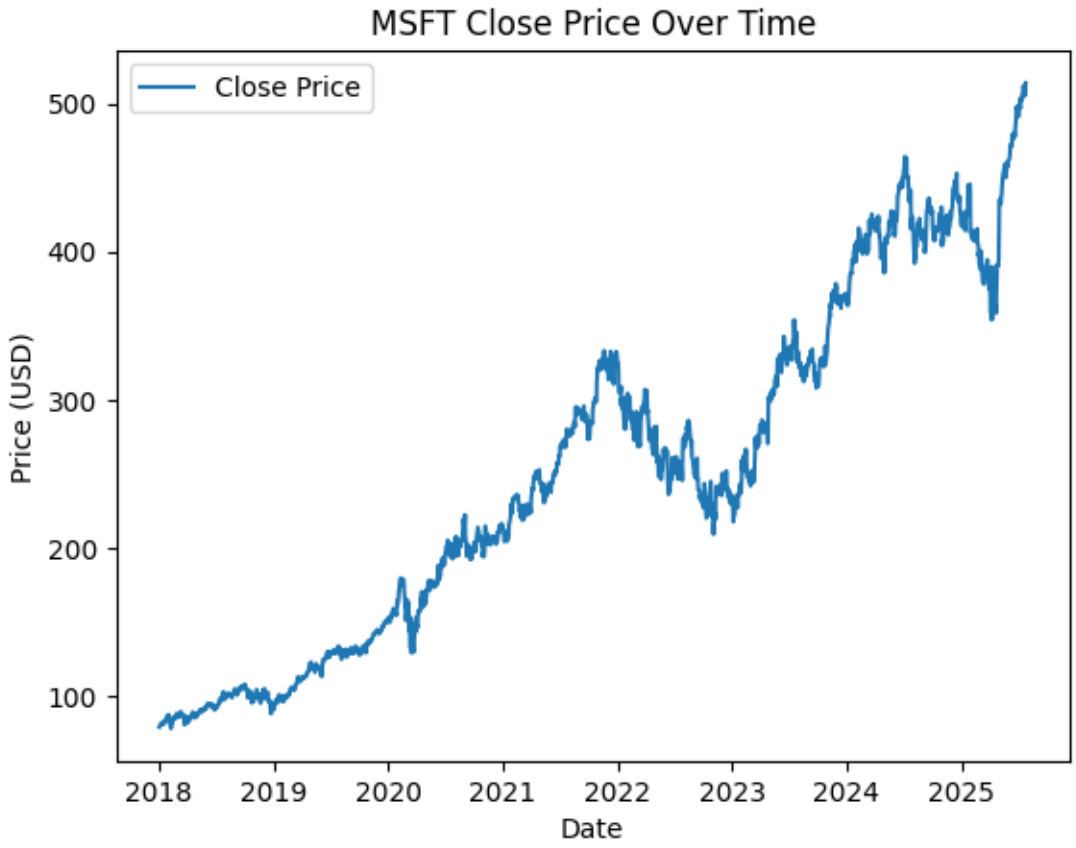
After First Differencing:

ADF Statistic: -14.0218

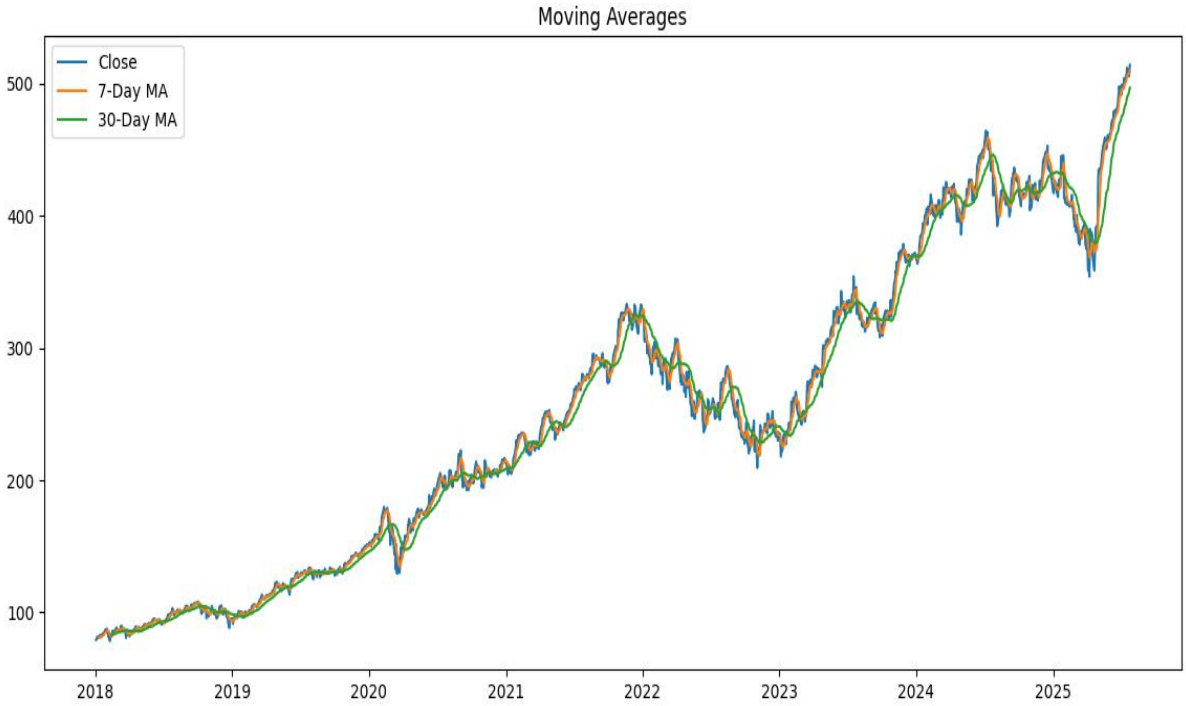
p-value: 3.56e-26

→ the series is now stationary.

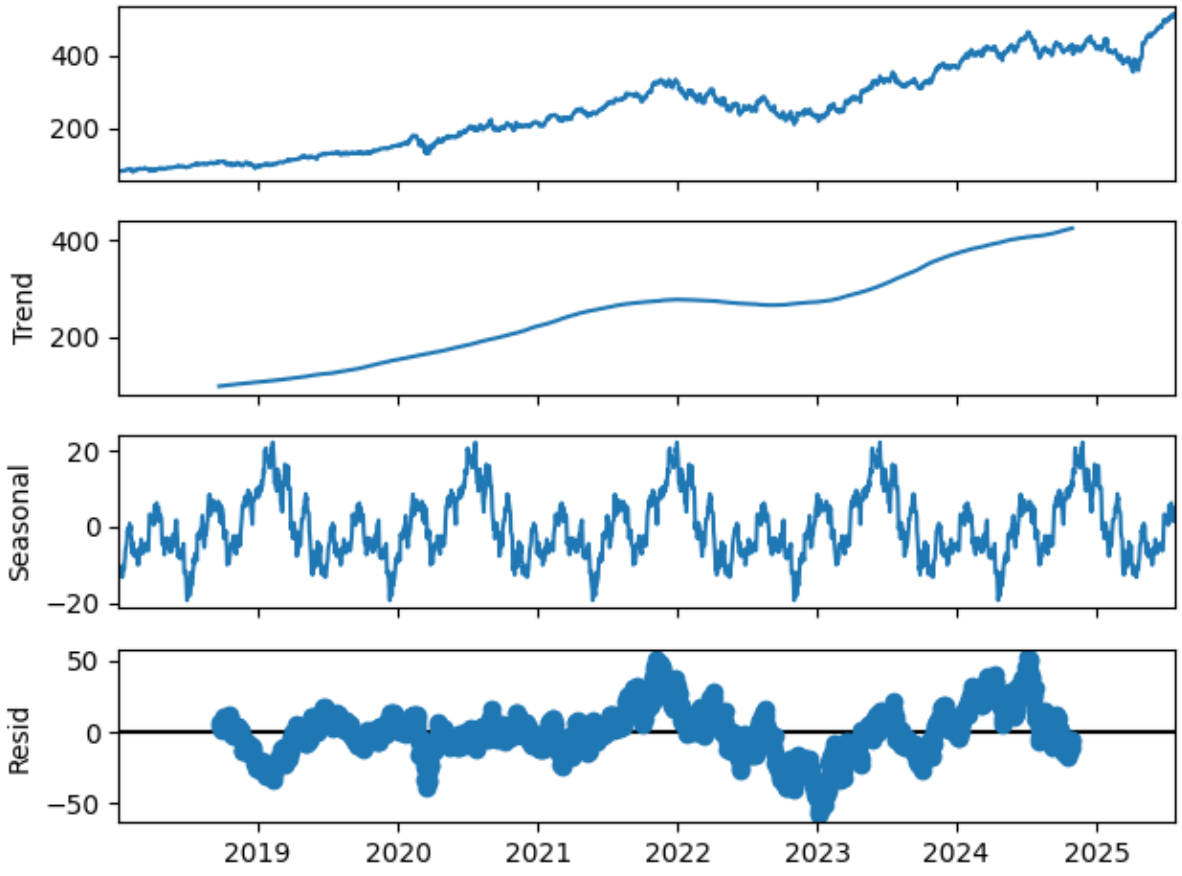
MSFT Close Price over Time Graph



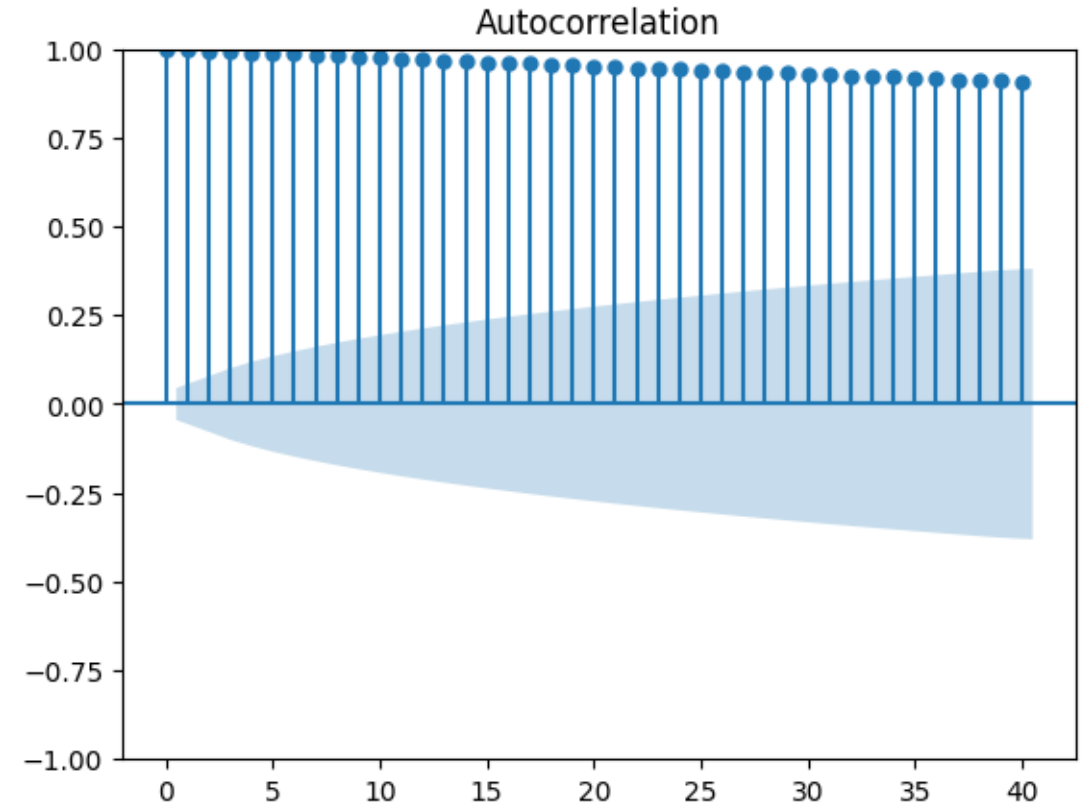
7-Day & 30-Day Moving Averages Graph



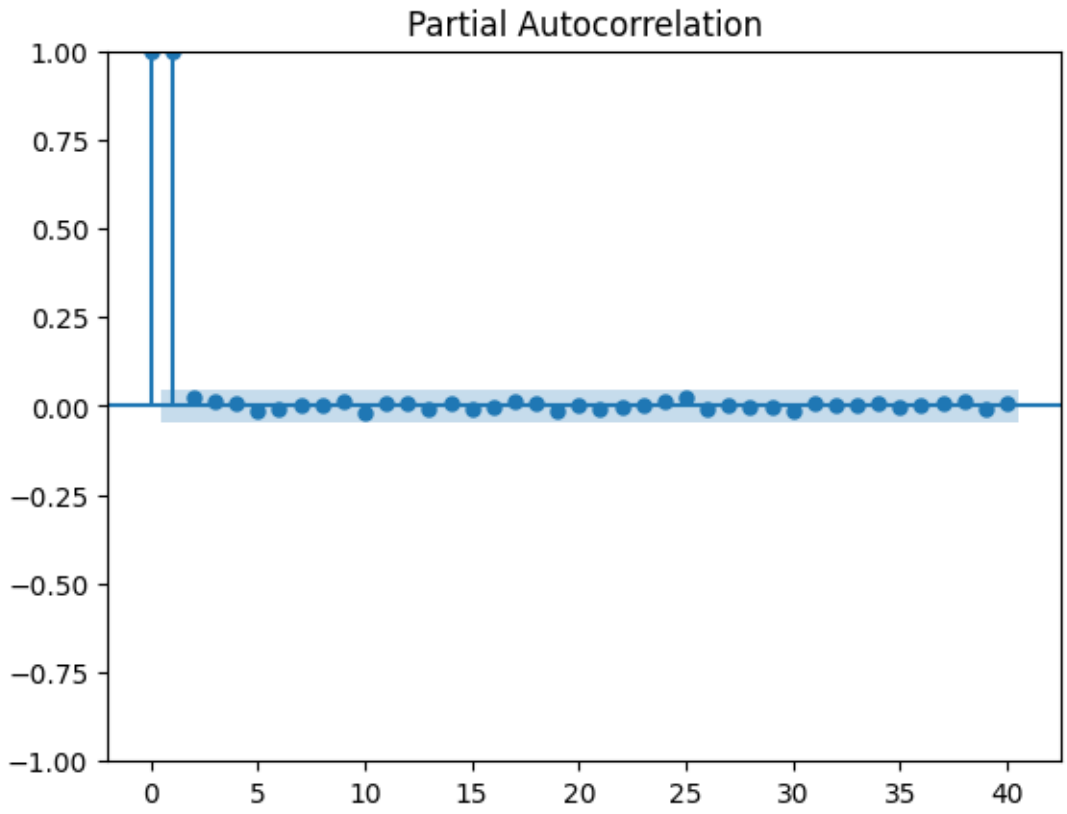
Seasonal Decomposition Plot



ACF Plot


Autocorrelation
1.00
0.75
0.50
0.25
0.00
−0.25
−0.50
−0.75
−1.00
0
5
10
15
20
25
30
35
40

PACF plot:



2. ARIMA Forecasting

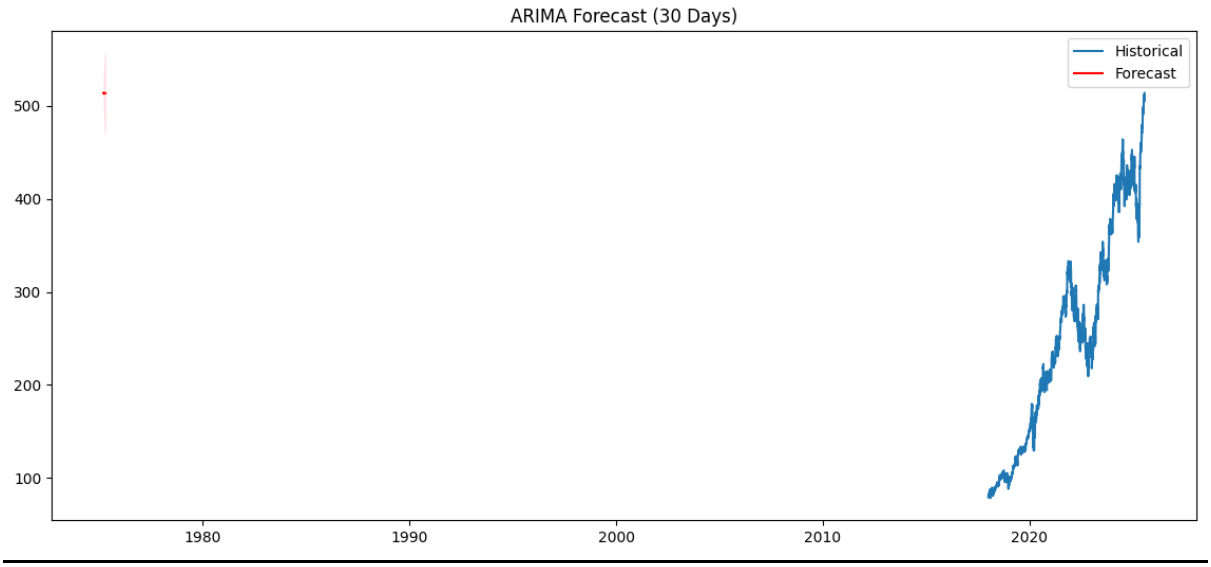
We applied an ARIMA(5,1,2) model. The model forecasted the next 30 days.

Evaluation:

MAE: 3.12

RMSE: 3.94

ARIMA Forecast Plot with Confidence Intervals



3. LSTM Forecasting:

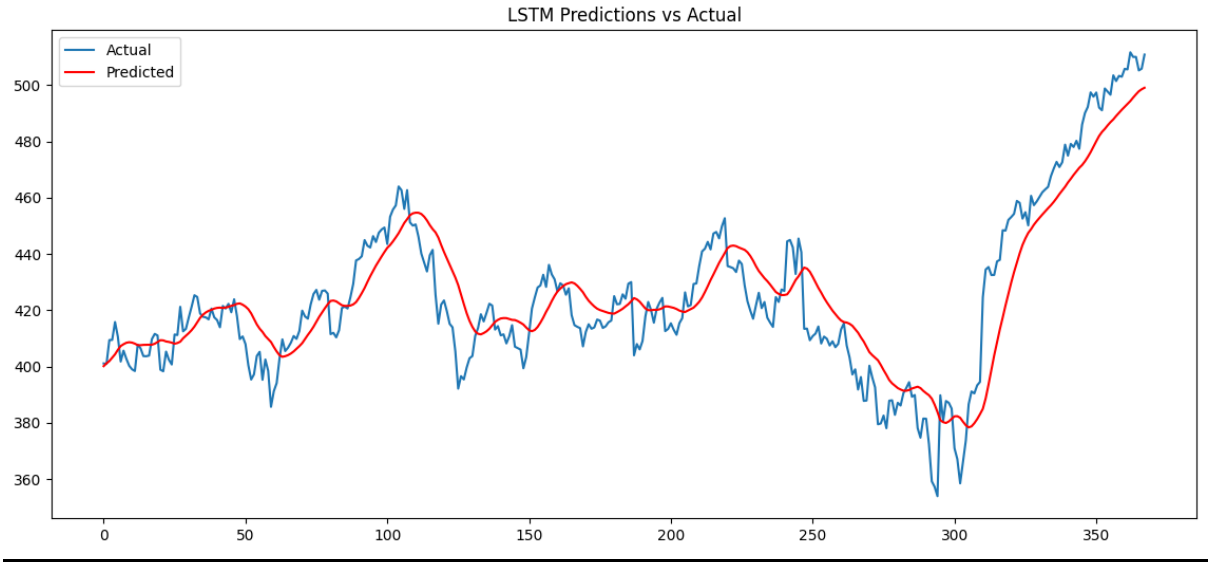
A deep learning LSTM model was trained on scaled data with a 60-day sliding window, trained for 10 epochs.

Evaluation:

MAE: 10.57

RMSE: 12.97

LSTM Predicted vs Actual Graph



4. Model Comparison & Conclusion

Summary:

- **ARIMA**

  MAE: 3.12

  RMSE: 3.94

- **LSTM**

  MAE: 10.57

  RMSE: 12.97

Reflection:

ARIMA clearly outperformed LSTM in this task. ARIMA is easier to interpret and delivered lower errors. LSTM, while powerful, struggled without additional tuning or longer training.

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