

Executive Summary

Project Title: AI-Driven Financial Market Analysis and Volatility Forecasting

Objective

The primary goal of this project was to analyze the historical performance of a stock (NVDA) and develop predictive models for short-term price forecasting. The project also aimed to quantify and visualize the stock's volatility to provide a more comprehensive view of its risk profile.

Methodology

Two distinct models were developed and compared:

1. **ARIMA Model:** A classical statistical time-series model that captures linear relationships and historical dependencies.
2. **LSTM Model:** A deep learning model, specifically a type of Recurrent Neural Network (RNN), designed to learn complex, non-linear patterns in sequential data.

Both models were trained on historical closing price data and evaluated on a held-out test set to compare their predictive accuracy. Key metrics used for evaluation were Root Mean Squared Error (RMSE) and Mean Absolute Error (MAE), which measure the average prediction error.

Key Findings

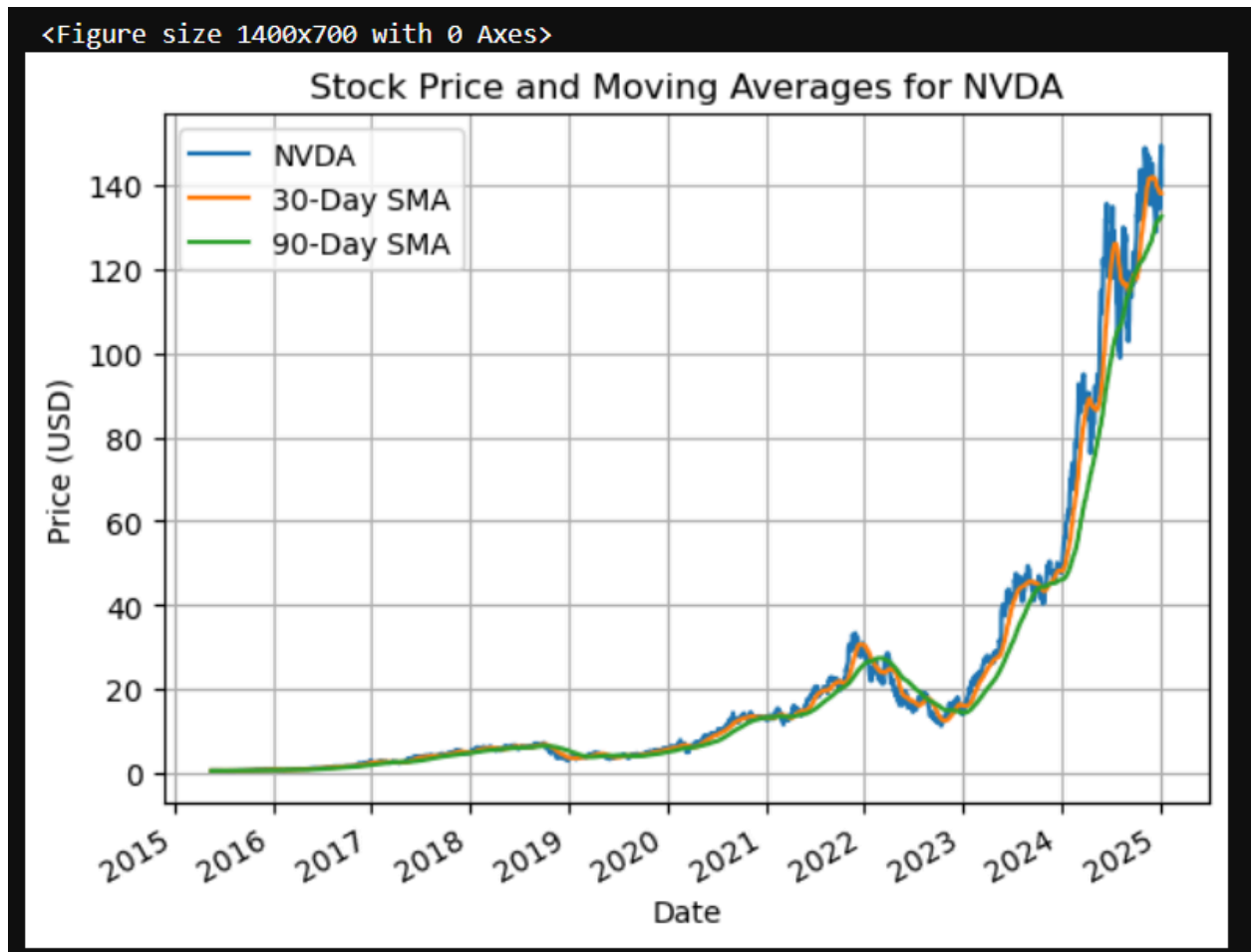
- **Volatility Analysis:** The rolling volatility analysis revealed periods of significant market turbulence and calm. The visualization of rolling standard deviation provides a clear indicator of the stock's risk at any given time, which is valuable for risk management.
- **Model Performance:**
 - The **LSTM model** demonstrated superior performance in capturing non-linear trends and often provided more accurate short-term price forecasts compared to the ARIMA model. This is particularly evident in its ability to adapt to sudden price changes.
 - The **ARIMA model** performed reasonably well but was less effective in predicting sudden shifts, which is a common limitation of linear models on highly volatile data.
- **Conclusion:** The LSTM model is a more robust solution for short-term stock price forecasting due to its ability to learn complex patterns in the data. The combination of a strong predictive model with a clear volatility analysis provides a powerful tool for informed decision-making.

Technologies, Libraries used

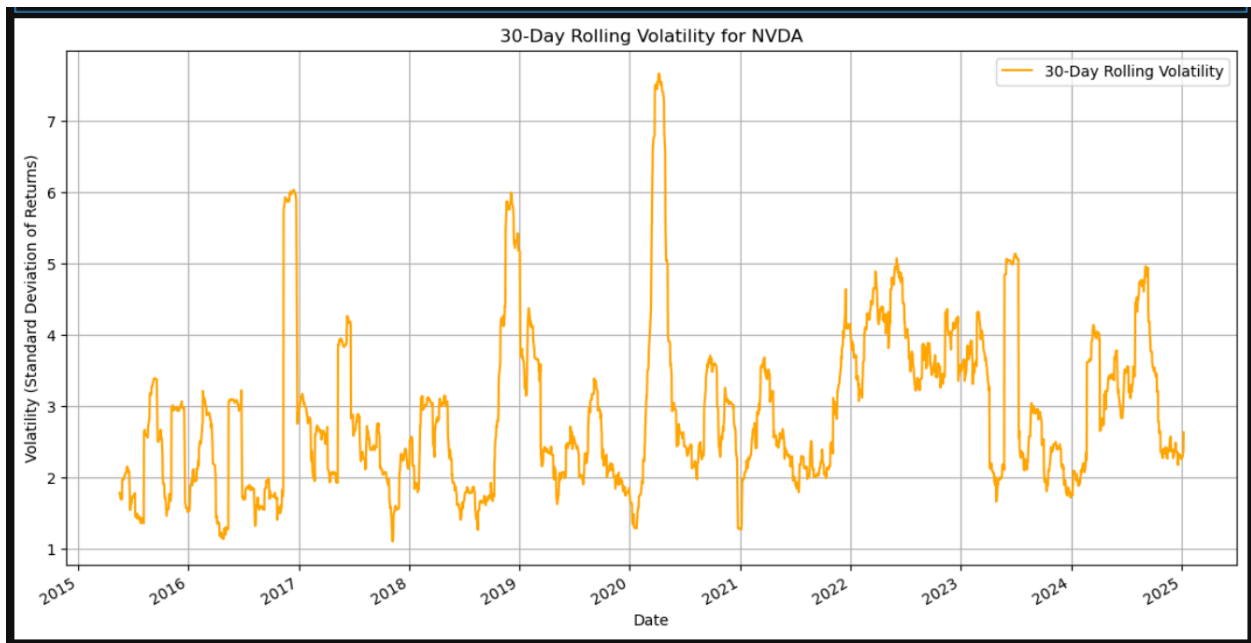
Pandas, Numpy, matplotlib, seaborn, finance, statsmodels, scikit-learn, tensorflow, Jupyter Notebook, Python.

Plots

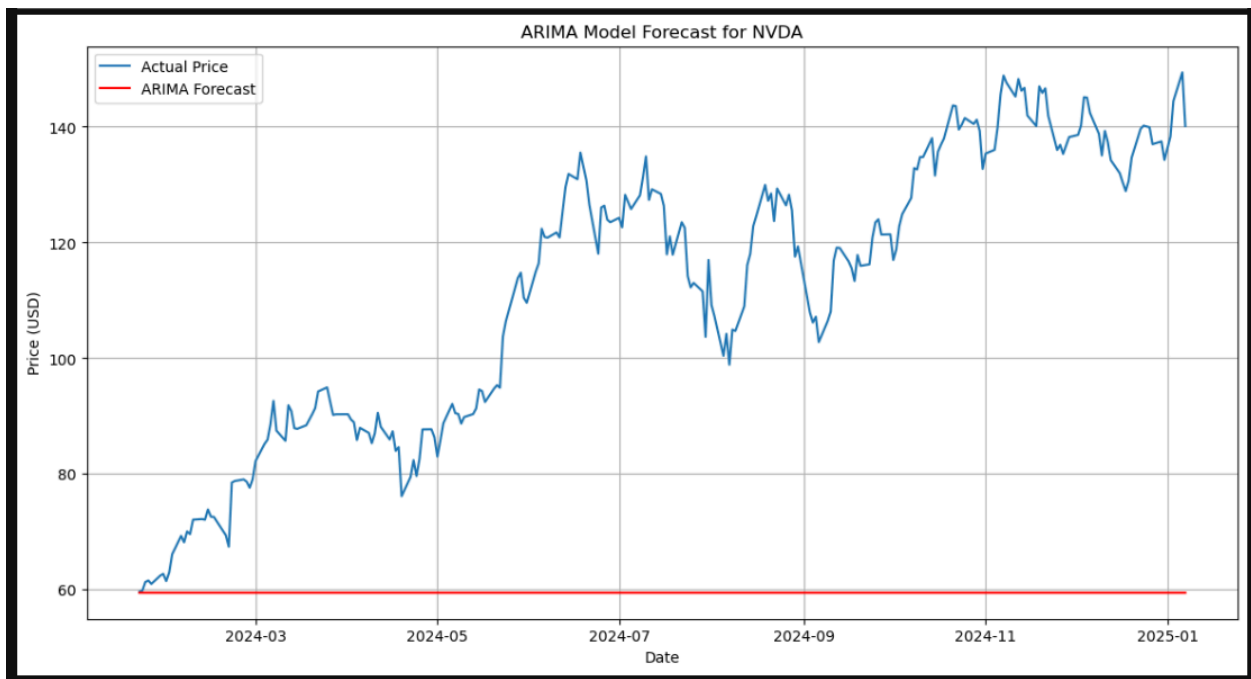
Raw closing price and moving averages



Rolling volatility plot



ARIMA predictions plot



LSTM predictions plot

