Department of Electrical and Computer Engineering
North South University (NSU)

CSE 440: Artificial Intelligence
Section 05

**Project**

Total Marks: 100
Proposal (20) + Execution (60) + Presentation (20)

Instructor: Dr. Mohammad Mahmudul Alam Semester: Spring 2025

| | |
|---|---|
| Title: | Stock Market Price Prediction Using Time Series Forecasting. |
| Name: | Habibur Rahaman Fahim |
| NSU ID: | 1911753042 |

Final Project

**Title:** Stock Market Price Prediction Using Time Series Forecasting.

**Abstract:**
The goal of this project is to use historical time series data to forecast and analyze NVIDIA's stock prices. To assess their predictive capabilities, we have analyzed contemporary machine learning methods (LSTM and XGBoost) and conventional statistical modeling (ARIMA). The Alpha Vantage API is the source of the data, which is then preprocessed for stationarity and subjected to seasonal decomposition analysis. Log-transformed closing prices are used to train and evaluate each model. With the lowest MAPE of 1.32%, the results demonstrate that the LSTM model performs noticeably better in forecasting accuracy than ARIMA and XGBoost. The research report shows how well deep learning algorithms can identify intricate temporal patterns in financial data.

**Introduction:**
Stock market forecasting has always been a crucial topic of finance, because of its significance for investments and the economy. The market behavior of NVIDIA Corporation, a prominent semiconductor and AI computing company, is tech-driven and volatile, making it an attractive candidate for time series analysis. In order to help analysts and investors make wise judgments, here we developed strong prediction models that can produce precise projections of NVIDIA's stock values. In our project there compared three models: XGBoost, LSTM, and ARIMA.

**Problem Statement:**
Predicting stock prices accurately is still a difficult and constantly changing task. Conventional models could produce less-than-ideal forecasts because they are unable to identify non-linear trends and abrupt shifts in the market. This study examines whether more sophisticated deep learning models—in particular, LSTM networks—can anticipate NVIDIA stock prices more accurately than machine learning algorithms like XGBoost and statistical models like ARIMA. For algorithmic trading methods, risk management, and financial decision-making, accurate modeling is essential.

**Methodology:**
The project follows these steps:

1. **Data Acquisition**: Real-world stock data was scraped from the Alpha Vantage API, covering several years of daily trading information.
2. **Preprocessing**:
    - Converted the dataset to business-day frequency.

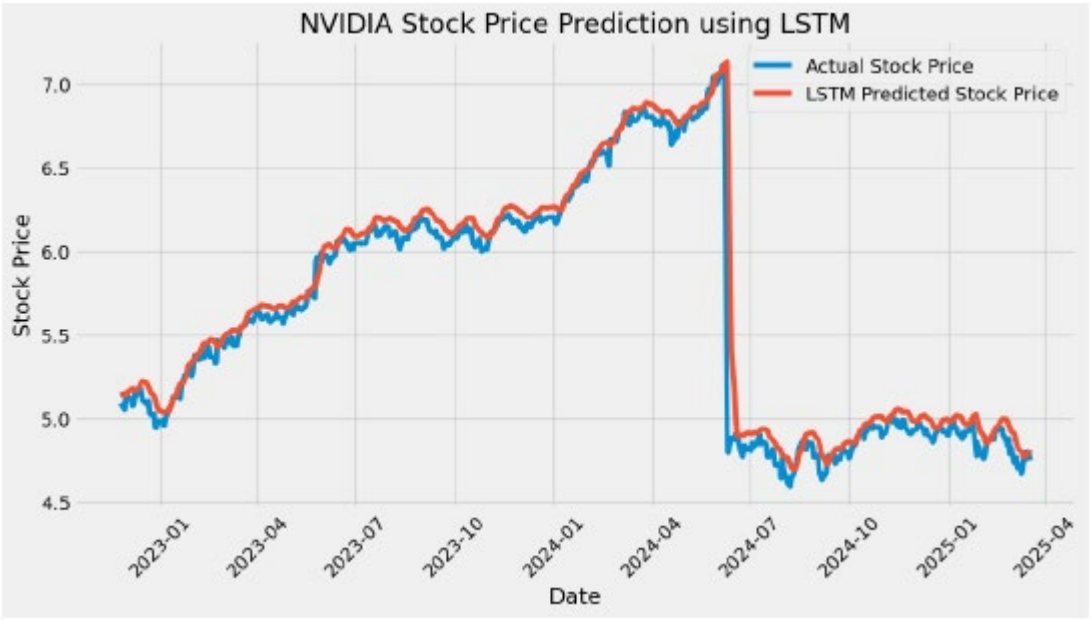
- Handled missing values with forward fill.
- Applied log transformation to stabilize variance.
- Split the dataset into training (90%) and test (10%) sets.

3. **ARIMA Modeling**:
   - Conducted Dickey-Fuller test for stationarity.
   - Used auto_arima for model selection.
   - Fitted ARIMA(1,1,2) model using statsmodels.
4. **LSTM Modeling**:
   - Scaled data using MinMaxScaler.
   - Created time-stepped sequences (60 timesteps).
   - Built and trained a two-layer LSTM model with dropout.
   - Used inverse scaling for interpretation.
5. **XGBoost Modeling**:
   - Created lagged features similar to LSTM setup.
   - Tuned parameters (max_depth, learning_rate, etc.).
   - Trained XGBRegressor and evaluated predictions.
6. **Evaluation Metrics**:
   - MSE (Mean Squared Error)
   - MAE (Mean Absolute Error)
   - RMSE (Root Mean Squared Error)
   - MAPE (Mean Absolute Percentage Error)

**Results:**

| **Model** | **MSE** | **MAE** | **RMSE** | **MAPE** |
|---|---|---|---|---|
| ARIMA | 0.9174 | 0.7040 | 0.9578 | 11.41% |
| LSTM | 0.0254 | 0.0706 | 0.1593 | **1.32%** |
| XGBoost | 0.2059 | 0.1882 | 0.4538 | 2.91% |

- **LSTM** had the lowest errors across all metrics, clearly outperforming ARIMA and XGBoost.




- **ARIMA** was the least accurate, struggling to capture non-linearities.

- **XGBoost** performed better than ARIMA but couldn't match LSTM's learning capacity.


**Conclusion:**

Here demonstrated how deep learning (LSTM) outperforms machine learning (XGBoost) and traditional statistical (ARIMA) approaches in stock price prediction. The LSTM model had a notable accuracy advantage due to its capacity to learn from non-linear patterns and long-term relationships. Even while ARIMA was simple to use and understand, it was unable to account for intricate market dynamics. The project research can be expanded in the future by adding sentiment analysis, multi-stock portfolios, or other market indicators. For increased resilience, hybrid models that combine LSTM and XGBoost may also be investigated.