AIM:

This project aims to evaluate and compare the performance of **Long Short-Term Memory (LSTM)** and **Linear Regression (LR)** models in forecasting the **'Open' prices of Apple Inc. (AAPL)** stock using historical data from **Yahoo Finance** spanning **2016 to 2024**. The goal is to determine how effective each model is at predicting stock prices across varying forecasting horizons — **short-term (3 months), medium-term (7 months), and long-term (10 months)**.

The dataset is partitioned as follows:

- **Training Set**: July 31, 2016 – July 31, 2021
- **Validation Set**: August 1, 2021 – December 31, 2023
- **Short-term Test Set**: January – March 2024
- **Medium-term Test Set**: January – July 2024
- **Long-term Test Set**: January – October 2024

Two modelling approaches are implemented:

1. **LSTM**: A deep learning model that captures temporal dependencies using a multi-step (5-day) forecasting approach with a 5-day input window, employing ReLU activations and dropout regularization.
2. **Linear Regression**: A baseline statistical model that uses a single lagged feature (`Prev_1`) and walk-forward validation to predict the next day's opening price.

The models are evaluated using multiple error metrics including:

- **Mean Squared Error (MSE)**
- **Root Mean Squared Error (RMSE)**
- **Mean Absolute Error (MAE)**
- **RMSE to Mean Ratio (RMSE/Mean)**
- **Coefficient of Determination ($R^2$ Score)**

The objective is to analyze and compare the **efficiency, robustness, and accuracy** of LSTM and Linear Regression models across **short-term, medium-term, and long-term forecasting** horizons to determine their suitability for stock market prediction tasks.