

## 1. Project Overview

This project focuses on **stock price forecasting** using Apple's stock (AAPL) from 2015–2023. We compared three models:

- **ARIMA (AutoRegressive Integrated Moving Average)** – a statistical model.
- **Prophet** – developed by Facebook, designed for time-series forecasting.
- **LSTM (Long Short-Term Memory)** – a deep learning model suitable for sequential data.

The goal is to evaluate which model performs best in capturing stock price patterns.

## 2. Methodology

### 1. Data Collection:

- Stock data collected from Yahoo Finance using the `yfinance` library.
- Used adjusted closing price for consistency.

### 2. Preprocessing:

- Train-test split (80-20 ratio).
- Stationarity checked with **ADF test**.
- Data normalized for LSTM.

### 3. Models Applied:

- **ARIMA (5,1,0)**: Good for linear, short-term forecasting.
- **Prophet**: Captures trend + daily seasonality.
- **LSTM**: Learns complex non-linear temporal dependencies.

### 4. Evaluation Metric:

- **RMSE (Root Mean Square Error)** used to measure prediction accuracy.

## 3. Results

- **ARIMA**: Provides reasonable short-term predictions but struggles with non-linear patterns.
- **Prophet**: Captures trend and seasonality effectively, easy to interpret.
- **LSTM**: Outperformed statistical models in accuracy (lower RMSE), capturing complex dependencies.

## 4. Strengths (Plus Points)

- ✓ Combination of **statistical, machine learning, and deep learning** models.
- ✓ Clear **visualizations** to compare actual vs predicted prices.
- ✓ Step-by-step process: data → models → evaluation.

- ✓ LSTM shows strong ability to capture stock volatility.
- ✓ Prophet is interpretable and useful for business applications.

## 5. Conclusion

- **Best Model:** LSTM (lowest RMSE, better captures stock dynamics).
- **ARIMA & Prophet:** Still useful as benchmarks and for simpler forecasting.
- **Practical Implication:** Deep learning offers improved accuracy but requires more computation, while statistical models are faster and easier to interpret.