📄 Project Report

Title: Time Series Analysis and Forecasting for Stock Market

Internship Organization: ZIDIO Technologies

Intern Name: Sehar Nawaz Ali

Duration: 4 Weeks

Tech Stack: Python, Prophet, LSTM, ARIMA, Matplotlib, TensorFlow

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1. Abstract

This project focuses on analyzing and forecasting stock market trends using time series models. We explored historical stock data of companies like Reliance and Tesla using ARIMA, SARIMA, Prophet, and LSTM models.
The goal was to uncover time-based patterns and make reliable predictions about future stock prices using a combination of statistical and deep learning approaches.
Through this, we gained real-world experience in financial data analysis, model evaluation, and result interpretation.

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2. Objective

- Understand time series characteristics like trend, seasonality, and noise.
- Implement forecasting models such as ARIMA, SARIMA, Prophet, and LSTM.
- Evaluate model accuracy and effectiveness.
- Visualize the results using appropriate plots and dashboards.

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3. Tools & Technologies Used

- **Programming Language:** Python
- **Libraries:** Pandas, NumPy, Matplotlib, Seaborn, yfinance, pmdarima, statsmodels
- **Forecasting Models:** ARIMA, SARIMA, Facebook Prophet, LSTM (via TensorFlow/Keras)

- **Visualization:** Matplotlib, Seaborn
- **Platform:** Google Colab / Jupyter Notebook

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4. Methodology

1. **Data Collection:**
    - Used `yfinance` to fetch historical stock data for Reliance (`RELIANCE.NS`) and Tesla (`TSLA`).
2. **Data Preprocessing:**
    - Cleaned the data, handled missing values, and extracted close prices.
3. **Exploratory Data Analysis (EDA):**
    - Visualized trends, rolling averages, and stationarity using plots and ADF test.
4. **Modeling:**
    - Applied **ARIMA** and **SARIMA** on Reliance data.
    - Implemented **Prophet** for trend + seasonality forecasting.
    - Built an **LSTM** model on Tesla data using deep learning layers.
5. **Evaluation:**
    - Used metrics like MSE, MAE, and residual plots to compare models.
6. **Visualization:**
    - Forecasted prices plotted against historical trends for better interpretation.

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5. Results & Insights

- **ARIMA & SARIMA:**
  Successfully captured linear and seasonal trends for Reliance stock. Residuals showed reasonably good model fit.

- **Prophet:**
  Gave a clear decomposition of trend and seasonality. Great for business-level forecasts.

- **LSTM:**
  Captured complex patterns in Tesla's stock prices. Showed strong prediction capability for future sequences.

- Visual outputs and evaluation metrics helped validate each model's accuracy and applicability.

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6. My Contribution (Sehar Nawaz Ali)

- Worked in a team and contributed primarily to the **Prophet** and **LSTM** model implementation.

- Handled:

    - Data preprocessing

    - Model training and fine-tuning

    - Visualization of results

    - Interpretation of outputs

- Supported documentation materials for the project.

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7. Learning Outcomes

- Learned about multiple time series forecasting models and their real-world applications.

- Developed skills in data preprocessing, model evaluation, and deep learning.

- Strengthened understanding of financial data analytics.

- Improved teamwork, documentation, and presentation skills.

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8. Conclusion

The project helped in building a deep understanding of time series analysis using both statistical and neural network-based models.
The insights generated can assist in financial decision-making and highlight the practical application of machine learning in stock market forecasting.
The combination of Prophet and LSTM brought together interpretability and prediction strength, making the models both insightful and robust.

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9. References

- Yahoo Finance
- Prophet Documentation – facebook.github.io/prophet
- TensorFlow/Keras LSTM Guides
- Kaggle Datasets and Forums
- Statsmodels and Pmdarima Docs
