

Project Overview

Project Title:

Comparative Analysis of Deep Learning Models and Traditional Time Series Models for Predicting NIFTY 50 Stock Prices

Summary of the Project Topic and Background:

This project compares deep learning models like Long Short-Term Memory (LSTM) with traditional time series models such as ARIMA and ARIMAX to predict NIFTY 50 stock prices. The NIFTY 50 index, which includes the top 50 companies listed on the National Stock Exchange of India (NSE), is a key benchmark for tracking the Indian stock market and economy.

Traditional models like ARIMA and ARIMAX identify linear trends and seasonal patterns but often struggle with the complex, non-linear nature of financial markets. In contrast, deep learning models like LSTM and GRU recognize long-term patterns and better capture stock price complexities.

Recent research supports this. Yavasani and Wang (2023) showed that LSTM and GRU outperformed ARIMA in predicting stock prices across sectors. Yasin Kirelli (2024) found LSTM provided more accurate predictions for technology stocks. A study in the Journal of Open Innovation (2024) highlighted that GRU models outperformed both LSTM and traditional models, especially for stable indices like NIFTY 50.

This project will explore whether deep learning models truly provide better predictions for NIFTY 50 stock prices compared to traditional models and their implications for investors and analysts seeking reliable forecasting tools.

Research Question:

Can deep learning models (LSTMs) outperform traditional time series models (ARIMA, ARIMAX) in predicting NIFTY 50 stock prices?

Project Goals:

1. Data Collection and Processing:

- Acquire and clean NIFTY 50 data by handling missing values, duplicates, and outliers.
- Apply feature engineering with moving averages, Relative Strength Index (RSI), and volatility indicators.
- Perform EDA to identify trends, patterns, and correlations.

2. Development of Predictive Models:

- Implement ARIMA, ARIMAX, LSTM models for stock price prediction.
- Optimize model performance.

3. Model Evaluation:

- Evaluate models using MSE, RMSE, and MAE to identify the best-performing model.

4. Data Visualization and Interpretation:

- Visualize results, including actual vs. predicted prices, residuals, and feature importance.
- Analyse the findings to determine the variables affecting changes in stock prices.

5. Summary and Strategic Insights:

- Consolidate findings, highlighting the model with the best accuracy and interpretability.
- Interpret results to identify factors influencing stock price fluctuations.

Project Plan: Task List and Timeline

Task	Description	Start Date	End Date	Duration
Choosing the Topic and Dataset	Define the research question and select a relevant stock dataset.	28 th Jan 2025	1 st Feb 2025	5 days
Understanding the Topic	Research stock prediction methods, including ARIMA, ARIMAX, and LSTM to choose the best approach.	1 st Feb 2025	7 th Feb 2025	1 week
Preparing the PDM Report and Presentation	Create a project plan (PDM report) with objectives, methods, and outcomes, and prepare a summary presentation.	8 th Feb 2025	10 th Feb 2025	3 days
PDM Plan Presentation	Present the PDM plan.	13 th Feb 2025	13 th Feb 2025	1 day
Data Cleaning and Preprocessing	Exploratory Data Analysis.	14 th Feb 2025	27 th Feb 2025	2 weeks
Literature Review	Review academic papers.	14 th Feb 2025	28 th Feb 2025	2 weeks
Developing Traditional Models	Implement ARIMA and ARIMAX models.	1 st Mar 2025	10 th Mar 2025	10 days
Building Deep Learning Models	Train LSTM model.	11 th Mar 2025	20 th Mar 2025	10 days
Data Ethics Quiz	Complete mandatory Data Ethics Quiz.	20 th Mar 2025	20 th Mar 2025	1 day
Hyperparameter Tuning	Optimize model performance using Cross-Validation.	21 st Mar 2025	30 th Mar 2025	10 days
Model Evaluation and Comparison	Evaluate and compare models using RMSE, MAE, and MAPE to identify the best performer.	31 st Mar 2025	6 th Apr 2025	1 week
Visualization and Interpretation of Results	Make graphs to show results and discuss important insights from the predictions.	7 th Apr 2025	13 th Apr 2025	1 week
Final Report and Presentation Preparation	Compile results into a final report and prepare for the presentation.	14 th Apr 2025	28 th Apr 2025	2 weeks
Report Submission	Submit report by April 29.	29 th Apr 2025	29 th Apr 2025	1 day
Viva Examination	Present and defend project.	13 th May 2025	13 th May 2025	1 day

Data Management Plan

Overview of the Dataset:

The dataset includes daily NIFTY 50 stock prices (2000-2021) with Open, High, Low, Close, and Volume, sourced from Kaggle (Rohan Rao).

Data Collection:

Source: [Kaggle Dataset - Nifty50 Stock Price Prediction](#)

Metadata:

- Format: CSV files
- Records: Approx. 5,000+ daily records for NIFTY 50 stocks

Document Control:**Code Storage & Version Control:**

- **GitHub:** Code will be saved on GitHub with regular, labeled commits.
- **GitHub Repository:** <https://github.com/RameshKelavath/StockPricePrediction>

Data Storage:

- **Local Storage:** Data will be stored locally in folders like **data/**, **code/**, and **outputs/**.

Data & Code Backup:

- **Backup Methods:** Code on GitHub, data on OneDrive.

ReadMe File:

- **Project Overview:** A brief explanation of the project's goals.
- **Configuration Guidelines:** How to install dependencies, run the code, and set up the project.
- **Dataset Details:** Historic NIFTY 50 data, sourced via Kaggle.
- **Guidelines for Usage:** How to train models and forecast stock prices using the code.
- **License:** Project-related licensing data.

Ethical Requirements:

- **GDPR Compliance:** Data is public, contains no personal information, and isn't subject to GDPR.
- **UH Ethical Policies:** As the study uses publicly available data and doesn't contain sensitive or personal information, it complies with UH ethical principles.
- **Permission to Use Data:** The dataset is publicly accessible on Kaggle, which allows for educational use.
- **Accessing Ethical Data:** The data was originally collected by reputable financial institutions (NSE), ensuring ethical practices.

Reference:

1. Sisodia, P.S., Ameta, G.K., Gupta, A. & Kumar, Y., 2022. *Stock Market Analysis and Prediction for Nifty50 using LSTM Deep Learning Approach*. In: 2nd International Conference on Innovative Practices in Technology and Management (ICIPTM). IEEE.
2. Adebisi, A.A., Adewumi, A.O. & Ayo, C.K., 2014. *Stock Price Prediction Using the ARIMA Model*. In: 16th International Conference on Computer Modelling and Simulation (UKSim-AMSS). IEEE.
3. Soni, P., Tewari, Y. & Krishnan, D., 2022. *Machine Learning Approaches in Stock Price Prediction: A Systematic Review*. *Journal of Physics: Conference Series*, 2161(1), p.012065.

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