HOSPITAL RESOURCE OPTIMIZATION USING TIME SERIES ANALYSIS

Leveraging ARIMA and LSTM Models for Predictive Analytics

INTRODUCTION

- Efficient management of hospital resources is critical for optimal patient care. This project utilizes predictive analytics to forecast hospital bed occupancy, enabling data-driven decision-making. ARIMA and LSTM models were developed and evaluated to achieve this goal.

BACKGROUND AND DEMO DATA

- The dataset used is a generated demo dataset representing patient admissions and discharges. Data includes timestamps for patient flow analysis, calculated as daily occupancy. Demo data was used to avoid restrictions, ensuring scalability and reproducibility.

METHODOLOGY

- 1. Data preprocessing and feature engineering for daily occupancy trends.

- 2. Developed ARIMA models to analyze linear trends and seasonal patterns.

- 3. Implemented LSTM models for capturing nonlinear patterns and temporal dependencies.

- 4. Evaluation metrics included MAE, RMSE, and MAPE to compare model performance.

RESULTS AND COMPARISON

Evaluation metric

ARIMA:

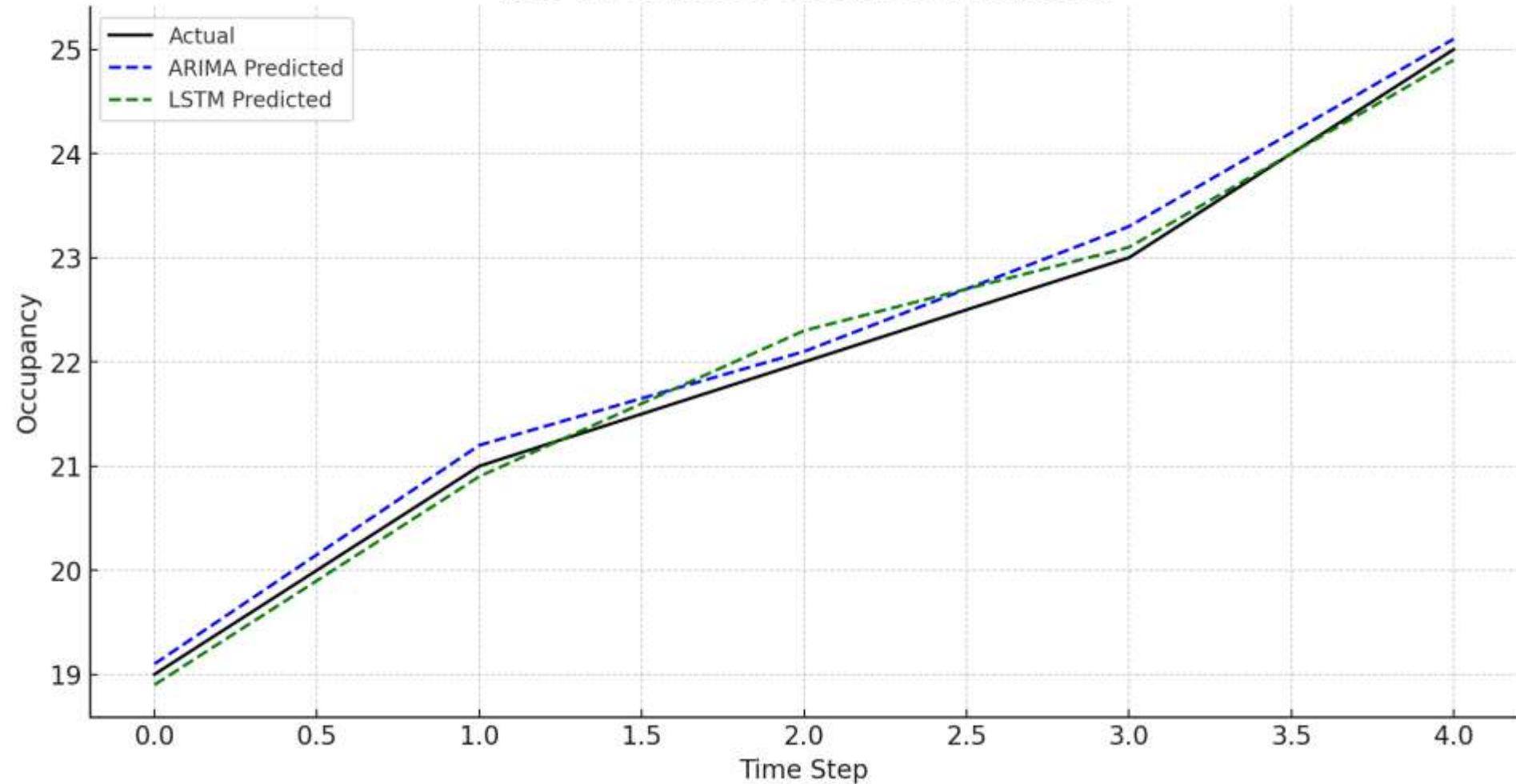- MAE: 19.69, RMSE: 24.07, MAPE: 8.72%

LSTM:

- MAE: 20.35, RMSE: 25.64, MAPE: 12.80%

Results: ARIMA outperformed LSTM in all evaluation metrics for this dataset.

ACTUAL VS PREDICTED VISUALIZATIONS FOR ARIMA

SUMMARY AND FUTURE PROSPECTS

Summary:

- ARIMA demonstrated superior performance for this dataset.

- Predictive analytics can support resource planning and hospital efficiency.

Future Prospects:

- Explore hybrid models combining ARIMA and LSTM for improved accuracy.

- Incorporate real-world datasets for validation and scalability.

- Extend analysis to other hospital resource metrics like staffing and equipment.