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Sales Forecasting for Strategic Business Planning: A Comparative Study of Time Series Models

Ms. Priya Keshav Patil[1], Saroja Shesherao Wanjarwade[2], Dr. Vaishali Kherdekar[3]
Student, MIT Arts, Commerce & Science College, Pune, India[1,2]
Assistant Professor, MIT Arts, Commerce & Science College, Pune, India[3]
patilpriya35789@gmail.com, wanjarwadesaroja@gmail.com, vakherdekar@mitacsc.edu.in

Abstract: *Accurate forecasting of sales data is fundamental for optimizing inventory, managing supply chains, and driving strategic decision-making in the e-commerce sector. This study presents a time series forecasting analysis of Amazon's monthly sales data from January 2019 to March 2024 using the Prophet model developed by Facebook. Prophet is an additive regression model designed to handle trend shifts, seasonal effects, and missing data with minimal manual parameter tuning. The dataset was preprocessedby aggregating daily transactions into monthly sales and applying seasonal decomposition to examine underlying patterns.*

The model's effectiveness was assessed using standard evaluation metrics, including Mean Absolute Error (MAE), Root Mean Squared Error (RMSE), and Mean Absolute Percentage Error (MAPE). It achieved a MAPE of 9.62%, reflecting a forecasting accuracy exceeding 90%.To contextualize Prophet's effectiveness, we reviewed comparative studies involving classical statistical models (ARIMA, SARIMA), deep learning approaches (LSTM), and hybrid methods. While those models often offer strong performance, they generally require more complex tuning and computational resources.

The findings confirm that Prophet can accurately model sales patterns in e-commerce applications, providing a practical balance of interpretability, scalability, and predictive performance. This work contributes to the broader literature on business forecasting by demonstrating Prophet's capability as a reliable alternative for mid-term retail sales prediction.

Keywords: Sales Forecasting, Time Series Forecasting, ARIMA, SARIMA, LSTM, Prophet, Machine Learning, Seasonality

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