

Forecasting Airline Ticket Prices: A Comparative Study of Time Series Models with Seasonal Trends

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Abstract: *Airfare pricing is a highly dynamic and complex process shaped by various factors such as changing demand, seasonal trends, airline strategies, and consumer behavior. Accurately predicting ticket prices is crucial—not just for travelers hoping to book flights at the best rates, but also for airlines aiming to maximize revenue through smart pricing. This study presents a comparative analysis of seven forecasting models: ARIMA, SARIMAX, Holt-Winters, Prophet, LSTM, XGBoost, and LightGBM, using real-world data from Indian domestic flights. Each model's performance is assessed using metrics like RMSE, MAE, MAPE, R² Score, and Accuracy. Among all, LightGBM stands out with the highest prediction accuracy, closely followed by XGBoost. In contrast, traditional time series models show limitations in capturing the complex seasonal and nonlinear patterns in airfare trends. These results highlight the effectiveness of ensemble and deep learning methods in price forecasting and support the development of smart fare prediction tools that can benefit both travelers and the airline industry..*

Keywords: airline pricing, airfare forecasting, LightGBM, LSTM, SARIMAX, ARIMA, machine learning, time series analysis, seasonality

