Analysing the Effectiveness of Deep Learning and Conventional Machine Learning Techniques in Time Series Forecasting of Daily Demand for an Automotive Product

Andreas Rükgauer [1], David Tumma , Christian Menden [1]

[1] Professor, Faculty of Economics and Business Administration, Technical University of Applied Sciences Würzburg-Schweinfurt, Würzburg, Germany; andreas.ruekgauer@thws.de, christian.menden@thws.de

Abstract: This study explores the effectiveness of deep learning and conventional machine learning techniques for time series forecasting of daily demand for an automotive product. We compare the performance of neural network architectures, including Long Short-Term Memory (LSTM), Gated Recurrent Units (GRU), Convolutional Neural Networks (CNN), a hybrid model (CNN-LSTM), with traditional Autoregressive Integrated Moving Average Models (ARIMA) and Holt-Winters exponential smoothing including related novelties such as eXtreme Gradient Boosting (XGBoost) and Prophet. The study also investigates the impact of different data preparation approaches on forecasting accuracy. The results demonstrate that deep learning models, particularly LSTM and GRU, outperform conventional techniques in capturing complex patterns and dependencies in the time series data under investigation. The data preparation approach, which uses a sequence of past elements to predict the next step, proves to be the most effective for multi-step forecasting. The findings provide valuable insights for improving demand forecasting accuracy in the automotive industry and optimizing production planning processes.

Keywords: production planning, production scheduling, automotive, neural networks, LSTM, CNN, GRU, ARIMA, forecasting, time series analysis