Do global forecasting models require frequent retraining?

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Abstract

In an era of increasing computational capabilities and growing environmental consciousness, organizations face a critical challenge in balancing the accuracy of their forecasting models with computational efficiency and sustainability. Global forecasting models, which leverage data across multiple time series to improve prediction accuracy, lowering the computational time, have gained significant attention over the years. However, the common practice of retraining these models with new observations raises important questions about the costs of producing forecasts. Using ten different machine learning and deep learning models, we analyzed various retraining scenarios, ranging from continuous updates to no retraining at all, across two large retail datasets. We showed that less frequent retraining strategies can maintain the forecast accuracy while reducing the computational costs, providing a more sustainable approach to large-scale forecasting. We also found that machine learning models are a marginally better choice to reduce the costs of forecasting when coupled with less frequent model retraining strategies as the frequency of the data increases. Our findings challenge the conventional belief that frequent retraining is essential for maintaining forecasting accuracy. Instead, periodic retraining offers a good balance between predictive performance and efficiency, both in the case of point and probabilistic forecasting. These insights provide actionable guidelines for organizations seeking to optimize forecasting pipelines while reducing costs and energy consumption.

Keywords: Time series, Demand forecasting, Forecasting competitions, Cross-learning, Global models, Machine learning, Deep learning, Green AI, Conformal predictions

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