Efficient industrial supply chain planning needs accurate forecasts. The number of necessary forecasts grows with the complexity of the supply network and the number of considered products.
Based on the example of an automotive supply chain, this work demonstrates how to generate relevant forecasts. In a first step, processes of production and logistics are described and the necessary planning steps and their dependencies are evaluated. Intermediate and final products are introduced as abstract forecasting objects defined by the dimensions time, product, geography and customers. This allows the exact determination of where and when to generate which types of forecasts.

The number of necessary forecasts grows exponentially with every additional characteristic of a product. For example, a product with two characteristics can be forecasted by two time-series. Forecasts for cars usually need to consider multiple characteristics, such as the model, the sales region and possible combinations of both. A growing number of characteristics quickly lead to high numbers of necessary forecasts.

This work proposes a process which allows the fitting of regression-based models using high-dimensional predictors. As a practical implementation, models based on Artificial Neural Networks and Random Forests are trained and different sets of hyper parameters are evaluated. The models are used to validate the hypothesis whether the integration of web-based online configurations as additional predictors increases the forecast's accuracy.

At a further step, an algorithm is proposed which allows the usage of short-term results from regression models to generate mid- to long-term forecasts.

Independent forecasts can be grouped as hierarchies. For example, both forecasts of a product with two characteristics can be summed up into a total forecast. This work proposes a reconciliation approach which allows the generation of high-dimensional coherent forecasts. An extension of the model considers multiple correlations given by Markov Models.

Summarized, the following three research questions are answered: (1) Which models and processes allow the integration of high-dimensional web configurations as predictors to forecast sales options in the automotive industry? (2) Does the integration of different predictors, especially the integration of online configurations increase the forecasting accuracy for sales options? (3) How can coherent forecasts be generated for high-dimensional hierarchies?

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