

# Pattern Similarity-based Methods for Forecasting Time Series with Multiple Seasonal Cycles

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## Abstract

Many time series exhibit multiple seasonal cycles of different lengths. Good example of such a time series is hourly electricity demand expressing three seasonal periods: daily, weekly and annual. The daily and weekly profiles change during the year. The daily profile depends on the day of the week as well. The load time series expresses also a trend and is nonstationary in mean and variance. These all features have to be captured by the flexible forecasting model. In the presentation pattern similarity-based methods for forecasting are described. A common feature of these methods is learning from the data and using similarities between patterns of the seasonal cycles of the time series. This approach based on the pattern similarity and local nonparametric regression simplifies the forecasting problem and enables us to develop effective forecasting models. Several models of this type are presented such as: nearest neighbor regression model, kernel regression model, and pattern clustering-based models including artificial immune systems. The advantages of the proposed models are their simplicity and a small number of parameters to be estimated, which implies simple optimization procedures. The models can successfully deal with missing data. The increased number of the model outputs does not complicate their structure. The simulation studies show that the proposed models are strong competitors for other popular univariate methods such as ARIMA and exponential smoothing.