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Generalized additive models for ensemble electricity demand forecasting

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Future grid management systems will coordinate distributed production and storage resources to manage, in a cost-effective fashion,
the increased load and variability brought by the electrification of transportation and by a higher share of weather-dependent production.
Electricity demand forecasts at a low level of aggregation will be key inputs for such systems. In this talk, I'll focus on forecasting demand at the individual household level,
which is more challenging than forecasting aggregate demand, due to the lower signal-to-noise ratio and to the heterogeneity of consumption patterns across households.
I'll describe a new ensemble method for probabilistic forecasting, which borrows strength across the households while accommodating their individual idiosyncrasies.
The first step consists of designing a set of models or 'experts' which capture different demand dynamics and fitting each of them to the data from each household.
Then the idea is to construct an aggregation of experts where the ensemble weights are estimated on the whole data set, the main innovation being that we let the weights vary with the covariates by adopting an additive model structure. In particular, the proposed aggregation method is an extension of regression stacking (Breiman, 1996) where the mixture weights are modelled using linear combinations of parametric, smooth or random effects.
The methods for building and fitting additive stacking models are implemented by the gamFactory R package, available at https://github.com/mfasiolo/gamFactory

References:

- Breiman, L., 1996. Stacked regressions. Machine learning, 24(1), pp.49-64.

Keywords

Electricity demand forecasting, regression stacking, smooth modelling

Special/invited session

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