TomKat Center for Sustainable Energy
Precourt Institute for Energy
SLAC National Accelerator Laboratory
Energy and Environment Affiliates Program
Civil and Environmental Engineering
Department of Electrical Engineering

Stanford University

Stanford Seminar

Forecasting Uncertainty in Electricity Smart Meter Data

Souhaib Ben Taieb

Monash University, Australia

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Abstract: Smart electricity meters are currently deployed in millions of households to collect detailed individual electricity consumption data. Compared to traditional electricity data based on aggregated consumption, smart meter data are much more volatile and less predictable. There is a need within the energy industry for probabilistic forecasts of household electricity consumption to quantify the uncertainty of future electricity demand, in order to undertake appropriate planning of generation and distribution. Smart meter data provide the data to meet this need. Much of the existing literature has focused on forecasting the average electric load (often called point forecasting); that is, in forecasting the mean of the future demand distribution, conditional on a number of predictor variables such as calendar and temperature variables. However, it has become increasingly important to forecast not only the conditional mean but the entire distribution of the future demand. In other words, a shift is occurring from point forecasting to probabilistic forecasting. The literature on probabilistic load forecasting is rather sparse, and is even more limited for smart meter data. We adopt a quantile regression approach where a different model is estimated for each quantile of the future distribution by minimizing the pinball loss. We propose to compare different quantile regression methods in terms of forecast accuracy for different quantiles and different forecast horizons. Our experiments will be based on a smart meter dataset collected from 3639 households in Ireland at 30-minute intervals over a period of 1.5 years. We discuss and present initial results together with some planned future work, including peak demand forecasting, hierarchical forecasting and whether considering customer behavior similarities can improve the forecast performance.

Bio: Dr. Souhaib Ben Taieb is a Postdoctoral research fellow in the Spatio-Temporal and Data analysis (STSDA) Group at KAUST in Saudi Arabia. Starting July 2015, Dr Ben Taieb will be Assistant Professor in Data Science at Monash Univeristy in Melbourne, Australia. Previously, he was at the Free University of Brussels in Belgium, where he received a B.Sc. and an M.Sc in Computer Science, and a Ph.D. in Computer Science with a focus in Machine learning. In 2010, he received the Research fellow grant from the Belgian National Science Foundation (FRS-FNRS). In 2013, he received the IEEE Power & Energy Society Award for ranking among the top five teams in the Global Energy Forecasting Competition 2012. Recently, Dr. Ben Taieb received the Best Contributed Submission at the Machine Learning and Data Analytics Symposium (MLDAS) co-organized by the Qatar Computing Research Institute (QCRI) and by The Boeing Company in Doha, Qatar. His main research interests include machine learning, statistical modeling and inference for time series, probabilistic time series forecasting, massive data analysis (big data) and smart grid analytics.