Electric Power and Power Electronics Institute

DATA-DRIVEN LEARNING IN POWER DISTRIBUTION NETWORKS

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Abstract

Increase in supply side variability due to increases in renewable generation requires demand side management strategies to reduce electricity delivery costs. Smart grid technologies provide opportunities for measuring and controlling distributed energy resources such as loads and storage at an unprecedented scale reducing the electricity delivery cost. Enabling this solution requires accurate models of the power distribution network and how consumer loads respond to various signals. This talk introduces data driven tools to resolve these two challenges. VISDOM (Visualization and Insight for Demand Operations and Management) is an open source framework to learn consumer behavior utilizing real experiments and observing smart meter data. The proposed methodology utilizes features derived from the data to postulate behavior models, and various algorithms to characterize consumption statistics, segment consumers and target the appropriate ones to programs. VADER (Visualization and Analytics for Distributed Energy Resources) is a platform that learns models of the distribution network fusing traditional utility data such as from SCADA with novel sources of information such as measurements from inverters and smart meters. We demonstrate how machine learning and statistical analysis can yield theoretical sound and more accurate models of the system as compared to traditional approaches. We conclude with an overview of future challenges, in particular how to learn models of electricity markets and aggregators from data.

Biography

Dr. Ram Rajagopal is an Assistant Professor of Civil and Environmental Engineering at Stanford University, where he directs the Stanford Sustainable Systems Lab (S3L), focused on large scale monitoring, data analytics and stochastic control for infrastructure networks, in particular power networks. His current research interests in power systems are in integration of renewables, smart distribution systems and demand-side data analytics. Prior to his current position he was a DSP Research Engineer at National Instruments and a Visiting Research Scientist at IBM Research. He holds a Ph.D. in Electrical Engineering and Computer Sciences and an M.A. in Statistics, both from the University of California Berkeley, Masters in Electrical and Computer Engineering from University of Texas, Austin and Bachelors in Electrical Engineering from the Federal University of Rio de Janeiro. He is a recipient of the NSF CAREER Award, Powell Foundation Fellowship, Berkeley Regents Fellowship and the Makhoul Conjecture Challenge award. He holds more than 30 patents and several best paper awards from his work, and has advised or founded various companies in the fields of sensor networks, power systems and data analytics.