



REALISTIC LEARNING IN POWER GRIDS: A PHYSICS-INFORMED MACHINE LEARNING PROSPECTIVE

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OVERVIEW

Distribution Grids provide the final tier in the transfer of electricity from generators to the end consumers. In recent years, smart controllable devices, residential generator/storage devices and distribution grid meters have expanded the availability of sensor data in distribution networks. Unveiling feeder topologies from data is of paramount importance to advance situational awareness and proper utilization of smart resources in power distribution grids. This talk summarizes recent works on topology identification for power distribution grids, under different regimes of measurement observability, using conservation laws of power-flow physics and structural properties of feeders. Analytical claims on feeder identifiability are reviewed under disparate meter placement scenarios. We provide links to results in phase detection and fault localization from our work. Further we discuss extensions to designing physics-informed deep neural networks for power grids, to overcome issues with reduced observability, low labels and measurement noise.

BIO

Dr. Deepjyoti Deka is a staff scientist in the Theoretical Division at Los Alamos National Laboratory, where he was previously a postdoctoral research associate at the Center for Nonlinear Studies. His research interests include data-driven analysis of power grid structure, operations and security, and stochastic optimization in social and physical networks. At LANL, Dr. Deka serves as a PI/co-PI for DOE and internal LDRD projects on machine learning in power systems, stochastic optimization of interdependent networks and in cyber-physical security. Before joining the laboratory, he received the M.S. and Ph.D. degrees in electrical and computer engineering (ECE) from the University of Texas, Austin, TX, in 2011 and 2015, respectively. He completed his undergraduate degree in electronics and communication engineering (ECE) from IIT Guwahati, India with an institute silver medal as the best outgoing student of the department in 2009. Dr. Deka is a senior member of IEEE and has served as an editor on IEEE Transactions on Smart Grid.

