EPRI | ELECTRIC POWER RESEARCH INSTITUTE

GEARED

GridEd

The Center for Grid Engineering Education

Predictive Analytics for Electric Power Distribution Systems – 12 PDH's

Course Description

This course is one in a series of several courses developed and offered by GridEd to address the evolving forces that will alter the fundamental operating characteristics of the electric grid, transforming it from a one-way central supply structure to one that has bidirectional power flows resulting from distributed energy resources (DER). Large numbers of self-generating consumers will alter the design requirements for the electric distribution system. New analytics techniques will be required to analyze, plan and operate the new grid.

This 1.5-day course focuses on applications of predictive analytics on smart electric power distribution systems and the use of Large Scale (Big) Data Analytical methods and their application to electric distribution system analysis and design. The basics of big data analytics and the electric power distribution system will be introduced. Four data-driven applications in electric power distribution systems will be studied closely. These include 1) Distribution system topology identification using smart meters data; 2) Distribution system power flow and state estimation; 3) Distributed energy resources adoption forecasting; and 4) Load and demand response forecasting. This is a first course in developing techniques to analyze the distribution system in a Big Data format. Six problem sessions and case studies are included in this interactive short-course.

Who Should Attend

The course is intended for anyone interested in understanding how predictive analytics can be applied to electric power distribution systems. Students will include utility engineers and technicians, business & strategy staff, regulatory compliance staff, legal staff, and possibly regulators. Previous technical training is helpful but not necessary.

Registration Information

Registration Fee:

- $1,200 per person
- 20% discount for organizations with three or more attendees
- 25% discount for government employees (non-utility)
- 25% discount for university professors*
- 75% discount for graduate students*

*University IDs required to qualify for professor or graduate student discounts.

Students need to bring: laptops or tablets to access online resources and to follow class notes. Wi-Fi access is provided. Lecture slides will be provided electronically in PDF format.

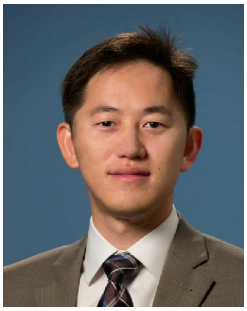
For More Information:

Amy Feser, afeser@epri.com, (865) 218-5909

Course Instructors:

Dr. Nanpeng (Eric) Yu - nyu@ece.ucr.edu

Meet the Instructors



Nanpeng (Eric) Yu, is an Assistant Professor in the Electrical and Computer Engineering department at the University of California, Riverside. His research interests are big data analytics in power distribution systems, electricity market design and optimization, distributed energy resources integration, and smart cities. Prior to joining UCR, Dr. Yu was a senior power system planner and project manager for demand response integration at Southern California Edison. Dr. Yu has published more than 30 papers in archival journals and international conference proceedings. Dr. Yu is a Senior Member of the IEEE. Dr. Yu serves as the co-chair for the IEEE PES big data applications in distribution network task force.
Dr. Yu received his M.Sc. in Electrical Engineering and Economics, and Ph.D. degree in Electrical Engineering from Iowa State University. Dr. Yu is the director of Smart Grid Innovation Laboratory at UC Riverside. He is also a cooperating faculty member of the department of Statistics. Dr. Yu currently serves as the associate editor for the International transactions on Electrical Energy Systems.

Course Outline

Topic 1: Brief Introduction of Data Driven Analytics in Smart Electric Power Distribution Systems

1.1 Introduction to data driven analytics
1.2 Applications of big data analytics in smart electric power distribution systems
1.3 Big data analytics platforms
1.4 Hadoop and MapReduce
1.5 Problem session: Hive, Pig, and MapReduce

Topic 2: Brief Introduction to Distribution Systems

2.1 Distribution Substations and Feeder Maps
2.2 The Nature of Loads
2.3 Problem Session: Develop diversification factor graph for distribution circuits
2.4 Modeling of distribution system lines
2.5 Modeling of voltage regulators
2.6 Modeling of transformers

Topic 3: Data-driven Application One: Distribution System Topology Identification

3.1 Introduction to machine learning algorithms
3.2 Unsupervised machine learning algorithm for phase identification
3.3 Supervised machine learning algorithm for phase identification
3.4 Transformer to customer association identification
3.5 Case study: Phase connectivity identification

Topic 4 Data-driven Application Two: Distribution System Power Flows and State Estimation

4.1 The Ladder iterative technique
4.2 The unbalanced three-phase distribution feeders power flow
4.3 State estimation in electric power distribution system
4.4 Case study: Three-phase distribution feeder power flow

Topic 5 Data-driven Application Three: Modeling and Forecasting of Solar PV

5.1 Technology adoption model
5.2 Case study for commercial solar PV adoption

Topic 6 Data-driven Application Four: Load and Demand Response Forecasting at the Substation Level

6.1 Statistical models for forecasting load or demand response
6.2 Case study: Estimating the load impact of demand response resources

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