EPRI | ELECTRIC POWER RESEARCH INSTITUTE

GEARED

GridEd

The Center for Grid Engineering Education

Big Data Analytics and Machine Learning in Smart Grid

Course Description

This course is one in a series of several courses developed and offered through GridEd to enhance workforce readiness through training and education of personnel with needed skill sets at the intersection of power systems and digital systems.

This 1-day course focuses on big data analytics and machine learning in smart grid. The value, velocity, volume, and variety of big data in smart grid will be discusses. The course will also review the basics of unsupervised learning, supervised learning, and reinforcement learning algorithms. Important applications of big data analytics and machine learning in electric power distribution systems, transmission networks, and electricity markets will be presented with real-world data set.

The applications covered in the short course includes:

Distribution Systems:
1) Topology identification, 2) Electricity theft detection, 3) Predictive maintenance of distribution equipment, 4) Estimation of behind-the-meter solar generation, 5) Reinforcement learning based Volt-VAR control and network reconfiguration.

Transmission System:
1) Anomaly detection with PMU data, 2) Motifs and signatures discovery with PMU data, 3) Segmentation of PMU data.

Electricity Market:
1) Algorithmic trading with virtual bids in electricity market.

Who Should Attend

The course is intended for anyone interested in understanding how big data analytics and machine learning can be applied to smart grid. Students will include utility engineers & technicians, data engineers and scientist, business & strategy staff, regulatory compliance staff, legal staff, and possibly regulators. Previous technical training is helpful but not necessary.

Registration Information

Date & Location: May 9th 8:00-5:00
Hilton St. Louis at The Ballpark
1 South Broadway
Gateway Ballroom
St. Louis, Missouri

Course Length: 1 days

PDH's Available: 8 hours

Registration Fee: $800 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.

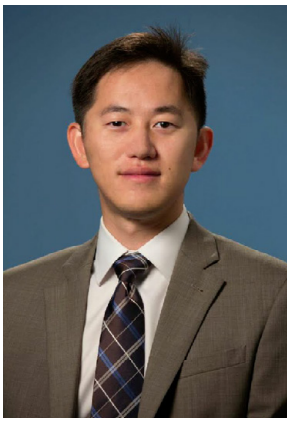
Registration Information

Course Instructor:

Instructor: Dr. Nanpeng (Eric) Yu, nyu@ece.ucr.edu

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

Meet the Instructor



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 and machine learning in smart grid, 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 50 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 computer science and department of Statistics. Dr. Yu currently serves as the associate editor for IEEE Transactions on Smart Grid and International transactions on Electrical Energy Systems.

Dr. Yu is the recipient of the Regents Faculty Fellowship and Regents Faculty Development award from University of California. His received a best paper award from the Second International Conference on Green Communications, Computing and Technologies and three best paper finalist awards from IEEE Power and Energy Society General Meeting.

Course Outline

Topic 1: Introduction to Data Driven Analytics and Machine Learning in Smart Grid

1.1 Introduction to data driven analytics and machine learning
1.2 Data Volume, Variety, Velocity, and Value
1.3 Applications of big data analytics and machine learning in smart grid

Topic 2 Introduction to Hadoop, HDFS, MapReduce, and Hive

2.1 Introduction to Hadoop
2.2 Cloudera's Distribution for Hadoop
2.3 Hadoop Distributed File System (HDFS)
2.4 MapReduce
2.5 Hive

Topic 3 Introduction to Machine Learning Algorithms

3.1 Unsupervised Machine Learning Algorithms
3.2 Supervised Machine Learning Algorithms
3.3. Reinforcement Learning Algorithms

Topic 4 Big Data and Machine Learning Applications in Power Distribution Systems

4.1 Topology identification
4.2 Electricity theft detection
4.3 Predictive maintenance of distribution equipment
4.4 Estimation of behind-the-meter solar generation
4.5 Reinforcement learning based controls in power distribution system

Topic 5 Big Data and Machine Learning Applications in Transmission Network

5.1 Anomaly detection with PMU data
5.2 Motifs and signatures discovery with PMU data
5.3 Segmentation of PMU data

Topic 6 Big Data and Machine Learning Application in Electricity Market

6.1 Algorithmic trading with virtual bids in electricity market

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