EPRI | ELECTRIC POWER RESEARCH INSTITUTE

GridEd

The Center for Grid Engineering Education

Machine Learning and Big Data Analytics in Smart Grid – 12 PDH's

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 1.5-day course focuses on machine learning and big data analytics in smart grid. The value, velocity, volume, and variety of big data in smart grid will be discussed. The course will also review the basics of unsupervised learning, supervised learning, reinforcement learning algorithms, and generative models. 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 control.

Transmission System: 1) Anomaly detection with PMU data, 2) Motifs and signatures discovery with PMU data, 3) Event classification with 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 technical directors and managers, 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

Dates and Times:

- March 22, 23, 24, 2021
- 1 pm – 5:30 pm EST
- Webex

Course Length: 1.5 day

PDH's Available: 12 hrs

Participants who attend the full course will receive a Certificate of Attendance with the appropriate number of Professional Development Hours for this course. Participants who attend the full course and pass an optional exam will be provided a Certificate of Completion.

Registration Fee: $100/hr/person

- 20% discount for organizations sending three or more staff
- 25% discount for government workers (non-utility)
- 25% discount for college professors*
- 75% discount for graduate students*

*University ID required

Location: Online - Live sessions will be recorded and available following the live web conference.

Register at: EPRI | U

EPRI Contacts:

Course Instructor:

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

Coordinator:

Amy Feser, afeser@epri.com

Participants will need access to an internet connection from a standard desktop/laptop computer equipped with speakers, microphone and common web browser, i.e. Internet Explorer, FireFox, Google Chrome, etc. Students will join live, synchronous web conference sessions via WebEx, with two-way voice capability through a telephone bridge. Sessions will be recorded and provided for ~4 weeks for later viewing.

Meet the Instructors

Nanpeng (Eric) Yu is an Associate 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 80 papers in archival journals and international conference proceedings. Dr. Yu is a Senior Member of the IEEE. Dr. Yu serves as the vice-chair of distribution system planning and operation subcommittee and the chair of data-driven modeling, monitoring, and control working group of IEEE Power and Energy Society.

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 Energy, Economics and Environment Research Center at University of California, Riverside. Professor Yu has been awarded over $9 Million of research and development funding from National Science Foundation, Department of Energy, California Energy Commission, National Renewable Energy Laboratory, and Electric utility Companies. 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, IEEE Transactions on Sustainable Energy, 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 several best paper awards from IEEE Power and Energy Society Grand International Conference and Exposition Asia, the Second International Conference on Green Communications, Computing and Technologies and 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 Machine Learning Algorithms

2.1 Unsupervised Machine Learning Algorithms

2.2 Supervised Machine Learning Algorithms

2.3. Reinforcement Learning Algorithms

2.4 Generative Models

Topic 3 Machine Learning and Big Data Applications in Power Distribution Systems

3.1 Topology identification

3.2 Electricity theft detection

3.3 Predictive maintenance of distribution equipment

3.4 Estimation of behind-the-meter solar generation

3.5 Reinforcement learning based controls in power distribution system

Topic 4 Big Data and Machine Learning Applications in Transmission Network

4.1 Anomaly detection with PMU data

4.2 Motifs and signatures discovery with PMU data

4.3 Event classification with PMU data

Topic 5 Big Data and Machine Learning Application in Electricity Market

5.1 Algorithmic trading with virtual bids in electricity market

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