

# IEEE Power and Energy Society

## Working Group Meeting

### Data-Driven Modeling, Monitoring, and Control in Power Distribution Networks

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# Working Group Activities

- › 2024 PES GM Panel Sessions
  - › Future of Utilities: Image Analytics and AI for Automated Drone Inspection
    - › Thursday, July 24, 2024. 3:00 PM – 5:00 PM. Room 439.
    - › Chair: Vladyslav Anderson. Co-Chair: Po-Chen Chen
  - › ML/AI for Electricity Market and Grid Operations Under Extreme Weather
    - › Wednesday, July 24, 2024. 10:00 AM – 12:00 PM. Room 440.
    - › Chair: Hao Zhu. Co-Chair: Nanpeng Yu.
  - › Involved in: Power System Synthetic Data Generation and Sharing
    - › Thursday, July 24, 2024. 10:0 AM – 12:00 PM.
    - › Chair: Yiyan Li. Co-Chair: Ning Lu.

# Tasks Group: Data-Driven Control in Power Distribution Systems

- ▶ Finished the first draft of a technical report entitled “Data-Driven Control, Optimization, and Decision-making in Active Distribution Networks”.
  - ▶ Contributors: Shaorong Zhang, Nanpeng Yu, Patricia Hidalgo-Gonzalez, Roel Dobbe, Yang Liu, Anamika Dubey, Jingtao Qin, Yubo Wang, John Dirkman, Haiwang Zhong, Ning Lu, Emily Ma, Zhaohao Ding, Di Cao, Junbo Zhao, Yuanqi Gao.
- ▶ Currently revising the technical report based on feedback and comments received from the community.
- ▶ Plan to submit the technical report and journal paper in Fall 2024.

# Tasks Force Proposal: Data-Driven Flexibility in Decarbonized Power Distribution Systems

- › Chair: Ioana Pisica. Co-Chair: Pedro Vergara Barrios. Secretary: Chung Sing Lai.
- › Background and Aim
  - › DER and EVs can provide increasingly valuable grid services such as peak reduction or shifting, frequency regulation, voltage support, and load balancing.
  - › The visibility of these resources is, however, extremely limited. Data-driven modelling, monitoring, and control allow the definition of new flexibility services at distribution level.
  - › The task force will firstly identify gaps in distribution system management and then it will propose data-driven algorithms to close these gaps, considering data access and availability issues.
- › Proposal submitted in Fall 2023 to BDA subcommittee.
- › Received Feedback in early July 2024.
- › Currently working on revising the proposal based on the committee feedback.

# Digital Power System Course

- › Developed with support from EPRI and DOE.
- › Dr. Nanpeng Yu and Dr. Hao Zhu contributed to the development of lecture modules in data science and its applications in power systems.
- › Course Outline
  - › Supervised Machine Learning
    - › Linear regression, robust regression, regularization (Theory and Application)
    - › Support vector machine (Theory and Application)
    - › Decision trees, random forest, and boosting tree (Theory and Application)
    - › Deep neural networks (FNN, CNN, RNN, Generative Model) (Theory and Application)
  - › Unsupervised Machine Learning
    - › Cluster analysis (Theory and Application)
    - › Dimensionality reduction (Theory and Application)
  - › Reinforcement Learning
    - › Markov decision process, action-value methods, policy-gradient methods, actor-critic methods, applications in power systems.

# Data Scientist for Power System Education

- › Motivation: with development of digital technology and cloud computing, the future generation of power system engineers are required to have certain level of data skills.
- › Goal: understanding the gap between traditional power system education/training and data science/analyst/SDE need in utility analytics teams.
- › Key Component: Education, Training, Recruiting, Evaluation.
- › Progress:
  - › Identified industry contact list
  - › Designed a google survey
- › Timeline:
  - › 2024/10: send out the survey.
  - › 2024/12: receive the survey.
  - › 2025/03: gather info and summarize information.
  - › 2025/06: produce summary and report.