UCONN
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ECE Spring 2025 Colloquium Series

Friday, April 4, 2025
11:15 am ITE 336
(Refreshments at 11 am)

Learning for Power Grid and Building Control

Prof. Yuanyuan Shi

In this talk, I will share our recent progress on developing learning algorithms for real-world energy system control, with stability and computational tractability guarantees. The first part is on reinforcement learning for power grid control. I will introduce a novel neural network architecture – monotone neural network (MNN) that ensure the network output is a monotone function of the input. MNN is achieved by first designing neural networks that are convex (with universal approximation guarantee) and using gradients of convex functions to ensure monotonicity. We show that MNN is a powerful structure for voltage control – with stability and optimality guarantees compared to standard neural networks. The second part is about operator learning for building control. There is an emergent need to model indoor air quality to improve occupant health and building energy efficiency. A fundamental challenge is that building airflow dynamics are governed by nonlinear partial differential equations (PDEs) with unknown parameters, which are computationally prohibitive from a real-time control perspective. I will introduce our work on PDE-constrained optimization for building model identification and designing neural operator learning for efficient PDE system control.

Bio:

Yuanyuan Shi is an Assistant Professor at the Department of Electrical and Computer Engineering at the University of California San Diego. She received her Ph.D. in Electrical Engineering, masters in Electrical Engineering and Statistics, all from the University of Washington, in 2020. From 2020 to 2021, she was a Postdoctoral Scholar at the California Institute of Technology. Her research interests lie in the areas of machine learning, dynamical systems and control, with applications in sustainable energy systems. She is a recipient of multiple awards, including the Rising Star award in EECS by MIT in 2018, the Scientific Achievement Award from the University of Washington Clean Energy Institute in 2020, and the best paper finalist from ACM e-Energy 2022, the Schmidt Sciences AI2050 Early Career Fellowship in 2024 and Hellman Fellowship in 2023.

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