CoCo Seminar Series Spring 2025

Separation of Learning and Control for Cyber-Physical Systems

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Hybrid (EB-R15 & Zoom; meeting link available on http://coco.binghamton.edu/)

Cyber-physical systems (CPS) consist of decentralized subsystems with dynamic real-time data. Traditional model-based control approaches struggle with inaccuracies, while supervised learning methods relying on offline data fail to ensure robust solutions. Direct reinforcement learning on real CPS raises safety concerns. This talk addresses these challenges in transportation-related applications, such as self-learning powertrain control, hybrid electric vehicle power management, and automated vehicle coordination. A novel framework integrating control theory and learning is introduced to optimize CPS control strategies. The key idea is to identify a sufficient information state that remains time-invariant. By leveraging separated control strategies, the framework decouples information state estimation from control execution. This allows the optimal control strategy to be derived offline while learning the information state online as new data is added. This approach ensures performance guarantees in various CPS applications, including smart power grids, networked control systems, cooperative robotics, and the Internet of Things.

Andreas Malikopoulos is a Professor in the School of Civil & Environmental Engineering and Director of the Information and Decision Science Lab at Cornell University. Previously, he was a faculty member at the University of Delaware (2017–2023), where he held the Terri Connor Kelly and John Kelly Career Development Professorship and founded the Sociotechnical Systems Center. Before that, he was a researcher at Oak Ridge National Laboratory (2010–2017) and General Motors R&D (2008–2010). He holds a Diploma from the National Technical University of Athens and M.S. and Ph.D. degrees from the University of Michigan, Ann Arbor, all in Mechanical Engineering. His research focuses on optimization and control of cyber-physical systems, decentralized stochastic systems, and learning in complex systems. Dr. Malikopoulos has received numerous awards, including the IEEE Intelligent Transportation Systems Young Researcher Award (2019) and UD's Outstanding Junior Faculty Award (2020). He has been recognized by the National Academy of Engineering and the National Academy of Sciences for his contributions. He serves as an Associate Editor for Automatica and IEEE journals on control and transportation systems and is a Senior Member of IEEE and a Fellow of ASME.

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