UC RIVERSIDE UNIVERSITY OF CALIFORNIA | Mechanical Engineering

The Department of Mechanical Engineering Presents

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Title: Nonsmooth Control Systems for Societal Networks with Data-Assisted Feedback Loops

Abstract: Recent technological advances have made devices for actuation, sensing, computation, and communication increasingly portable, inexpensive, and prevalent in societal engineering network systems. Examples include connected autonomous vehicles, robotic networks, the power grid -and its emergent energy markets-, and intelligent transportation systems. The emerging use of purely data-driven mechanisms to control and optimize in real time these complex network systems has led to the awareness of the pitfalls of model-free decision making without stability and robustness guarantees. This limitation is further exacerbated by the complex interactions that emerge between continuous-time and discrete-time dynamics in closed-loop systems, which makes difficult the development of rigorous stability, convergence, and robustness certificates via control theoretic tools. To address these challenges, in this talk I will present some of our recent advances in the context of feedback control with data-assisted feedback loops, with a focus on nonsmooth and hybrid control approaches. The proposed controllers are suitable for the solution of model-free control, optimization, and coordination problems in complex dynamical systems subject to topological constraints, high-performance requirements, and safety demands. The algorithms exploit non-Lipschitz and hybrid (continuous and discrete) dynamics to overcome fundamental limitations of standard smooth adaptive algorithms, achieving accelerated model-free control without sacrificing critical stability and robustness guarantees. Extensions to model-free time-varying decision-making problems in game theoretic settings will also be discussed in the context of coordinated network games. Applications in robotic networks, transportation systems, and energy systems will be presented to illustrate the main results.

About the Speaker: Jorge I. Poveda is an Assistant Professor in the Department of Electrical, Computer, and Energy Engineering at the University of Colorado, Boulder. He received the M.Sc. and Ph.D. degrees in Electrical and Computer Engineering from UC Santa Barbara in 2016 and 2018, respectively. Before joining CU Boulder in 2019, he was a Postdoctoral Fellow at Harvard University, and a summer research intern at the Mitsubishi Electric Research Laboratories, Cambridge, MA during 2016 and 2017. He has received the CCDC 2013 Outstanding Scholar Fellowship and the 2020 Best Ph.D. Dissertation awards at UC Santa Barbara, the NSF 2020 CRII and 2022 CAREER awards, the 2022 AFOSR Young Investigator Program (YIP) award, the 2022 campus-wide Research and Innovation Faculty Fellowship at CU Boulder, and the Best Student Paper Finalist awards at the IEEE Conference on Decision and Control as student in 2017, and as co-author in 2021. His research interests include hybrid and nonlinear control theory, adaptive and data-assisted algorithms, network games, and their applications in robotics, autonomous systems, and cyber-physical systems.

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