

Provable safety enforcement in reinforcement learning-based control for aerospace applications

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Abstract: In this talk, Dr. Mehr presents a framework for learning control policies that provably satisfy safety constraints in reinforcement learning, even when the system dynamics are unknown. The speaker moves beyond traditional approaches that rely on penalties or approximate safety certificates and instead enforces hard constraints directly in a closed loop by shaping the structure of the learned policy. Dr. Mehr introduces the key idea of constructing a buffer region around unsafe states and training policies that actively repel the system from constraint boundaries while remaining verifiable. Dr. Mehr first developed this idea for simple constraints and then extended it to more challenging settings where constraints involve higher-order dynamics and inertia, and showed how we can still guarantee safety. Overall, this talk will highlight a path toward deploying learning-based controllers in safety-critical robotic systems with formal guarantees.

Bio: Negar Mehr is an assistant professor in the Department of Mechanical Engineering at the University of California, Berkeley. Previously, she was an assistant professor of Aerospace Engineering at the University of Illinois Urbana-Champaign. Before that, she was a postdoctoral scholar in the Department of Aeronautics and Astronautics at Stanford. She received her Ph.D. in Mechanical Engineering from UC Berkeley in 2019 and her B.Sc. in Mechanical Engineering from Sharif University of Technology, Tehran, Iran, in 2013. She is a recipient of the NSF CAREER Award and the ONR Young Investigator Program (YIP) award. She was recently recognized as a rising star by the American Society of Mechanical Engineers (ASME). She was awarded the IEEE Intelligent Transportation Systems Best Ph.D. Dissertation Award in 2020.