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Autonomous systems in the intersection of control, learning, and formal methods

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ABSTRACT:

Autonomous systems are emerging as a driving technology for countlessly many applications. Numerous disciplines tackle the challenges toward making these systems trustworthy, adaptable, user-friendly, and economical. On the other hand, the existing disciplinary boundaries delay and possibly even obstruct progress. I argue that the nonconventional problems that arise in designing and verifying autonomous systems require hybrid solutions at the intersection of control, learning, and formal methods (among other disciplines). I will present examples of such hybrid solutions in the context of learning in sequential decision-making processes. These results offer novel means for effectively integrating physics-based, contextual, or structural prior knowledge into data-driven learning algorithms. They improve data efficiency by several orders of magnitude and generalizability to environments and tasks the system had not previously experienced. I will conclude with remarks on a few promising future research directions.

BIOGRAPHY:

Ufuk Topcu is a Professor in the Department of Aerospace Engineering and Engineering Mechanics at The University of Texas at Austin, where he holds W.A. “Tex” Moncrief, Jr. Chair in Computational Engineering and Sciences VI. He is a core faculty member at Texas Robotics and the Oden Institute for Computational Engineering and Sciences and the director of the Center for Autonomy. His research focuses on the theoretical and algorithmic aspects of the design and verification of autonomous systems.