INDUSTRIAL & SYSTEMS ENGINEERING
UNIVERSITY of WASHINGTON

Safe Large-scale Autonomy under Resource Congestion and Uncertainty

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Abstract: As the scale of operation grows in robotics and aerospace, how can a fleet of vehicles complete individual tasks in a resource-congested operation space? Using a combination of stochastic control, game theory, and optimization. I will first introduce and solve a Markov decision process congestion game model that balances task completion with collision avoidance, as well as demonstrate its applications in commercial air spaces, warehouses, and competitive ride-hail settings. Taking on the perspective of a single vehicle, I will introduce a set-theoretical framework for analyzing Markov decision processes under both static and time-varying parameter uncertainty, and prove the existence of invariant value function sets for Bellman iteration and policy evaluation. I will end with a discussion of how these techniques can improve the safety and efficiency of autonomy at scale.

Bio: Sarah H.Q. Li is a Ph.D. candidate in Aeronautics and Astronautics Engineering at the University of Washington and received her B.A.Sc. in Engineering Physics from the University of British Columbia. Her research combines game theory, control, and optimization to enable large-scale autonomy in disruption-prone and human-interactive settings such as urban air mobility, roadways, and automated warehouses. She is a 2020 Zonta International Amelia Earhart Fellow and a 2022 UW Aero&Astro Condit Fellow.

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