University of Colorado Boulder

Robotics Summer Student Seminar

June 17, 2021

Sarah Aguasvivas-Manzano

Deployed Intelligence in Robotic Materials

Robotic materials are materials that tightly combine sensing, actuation, computation and communication. With the advent of advanced robotic material fabrication techniques that produce novel sensing and actuation, there also exists an opportunity to integrate computation and communication to create truly autonomous materials. For computation and communication, robotic materials use low-power edge devices. We integrate computing and communication into these devices, ultimately composing those materials into huge distributed computing platforms that can adapt, predict and learn, much like the human brain. With the slow-down of Moore's Law in the past decades we assume that high-level high-power algorithms will need a simpler, more lightweight equivalence.

Sarah is a fifth-year PhD student in the Computer Science Department at CU Boulder. She previously got her BS and MS in aerospace engineering at Penn State University. Her research interests are prediction and control applied to the embedded systems at the robotic materials' edge IoT devices. Sarah is a recipient of the Berkeley Rising Stars Workshop recognition.

Kandai Watanabe

Probabilistic Specification Learning for Planning with Safety Constraints

Autonomous robots are becoming inevitable parts of our society, operating in various applications from deep-sea exploration to human-shared assembly lines. As they advance to these domains, robots are expected to perform challenging tasks whose specifications are often difficult if not impossible to accurately define. To address this challenge, in this talk, I introduce an approach that focuses on learning a complex task from demonstrations as a formal specification. I formulate this problem as a grammatical inference problem, wherein the task is learned as a probabilistic automaton whose edge probabilities represent demonstrators' preferences. I also show that we can incorporate safety specifications during the learning process and prove that the resulting automaton always respects the safety property. I discuss the generality of the method and show that it can easily be integrated into any Evidence-Driven State Merging (EDSM)-based automaton learning algorithms. Moreover, I introduce a planning algorithm that produces the most desirable (user-preferred) plan by maximizing the probability of an accepting trace of the automaton. In the case studies, I show that our algorithm learns the true probability distribution accurately while maintaining safety on a variety of mobile robots and manipulators.

Kandai Watanabe is a second-year Ph.D. student in the Computer Science Department at the University of Colorado Boulder. He got his Bachelor's and Master's Degree at Keio University, Japan, and also studied at the University of Illinois at Urbana Champaign during his Bachelor's Degree. His research interest lies in the intersection of Formal Verification, Robotics, and Human-Robot-Interaction, where he is seeking to combine high-level task learning with low-level policy learning while ensuring safety for human-robot interaction. At ARIA (Assured Reliable Interactive Autonomous) Systems Group, he is currently investigating novel algorithms for learning task specifications from demonstrations. Kandai is a recipient of the Japan Student Services Organization (JASSO) Overseas Graduate Fellowship and Keio University Global Fellowship.

Location: AERO 120, located at 3775 Discovery Drive.

Parking: Lot 550 (https://www.colorado.edu/map/?id=336#!m/445898).

Covid-19 guidelines: Audience will wear masks as per University policy until otherwise updated (https://www.colorado.edu/covid-19).

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