

EdgeRobot Summer Research Seminar #2

Time: Friday 7/29 1:30pm - 3:00pm PST (Pacific Standard Time)

Zoom Link: <https://csudh.zoom.us/j/2187602128>

Presentation 1:

Title: Cooperative Tracking of Multiple Targets in Flexible Formation Patterns

Speaker: Lili Ma, Department of Computer Engineering Technology, CUNY-New York City College of Technology (City Tech)

Abstract: Controlling a group of robots to achieve a common task has found applications in areas such as warehouse or patrolling. In many cases, the robots need to follow a desired trajectory as a group while maintaining certain formation patterns locally within the group, referred to as cooperative target tracking.

Traditional approaches based on graph theory and classic control theory typically requires relatively precise modeling of the environment and the robots. They are thus hard to be generalized to new environments directly. This research aims to achieve versatile and re-configurable formations with human awareness by resorting to multi-agent reinforcement learning (MARL)-assisted approaches. The objective is to provide EdgeRobot with learning capabilities to work in dynamic and human-populated environments. The designed robotic control algorithms will integrate traditional graph theory-based control solutions with MARL-based learning, estimation of motion intentions of people, adaption, and decision making.

Short Bio: Lili Ma received her Ph.D. in Electrical Engineering from Utah State University focusing on autonomous ground vehicles in 2004. After that she did three-year post-doctoral training at Virginia Tech working with autonomous aerial vehicles. Prior to joining the Computer Engineering Technology department at New York City College of Technology in 2016, she taught at Wentworth Institute of Technology for many years. Her research areas include autonomous robots, vision-based control, visual servoing, visual tracking, coordinated control, sensing and perception techniques. Dr. Ma has served as an associate editor for American Control Conference since 2017.

Presentation 2:

Title: Hardware for Secure Autonomy

Speaker: Tanvir Arafin, Assistant Professor, Electrical and Computer Engineering Department, Morgan State University

Abstract: Artificial intelligence (AI) powered autonomous systems have a sub-par track record in hardware-oriented security and trust issues. Fortunately, computing hardware does not need to be the weakest link in security; instead, the entropy-rich physical layer can offer novel solutions

ranging from unclonable functions to physical root-of-trust to build the foundations of robust and resilient smart systems. Therefore, closer scrutiny of the role of hardware in autonomous systems security is critical for engineering the next generation of reliable and trustworthy cyberspace.

In this talk, I will present my research on the opportunities and challenges of hardware-oriented security solutions for autonomous systems. First, I will review my experiments that demonstrate how physical and side-channel signatures such as clock drift and synchronization dynamics help anchor trust in a network of untrusted devices and system components. Second, I will describe the application of physical (un)cloneable functions and signatures in protecting distributed learning and sensing platforms from attacks such as sensor spoofing, fault injection, and model manipulation. Finally, I will discuss my works on cryptographic accelerators for power-constrained edge components in autonomous systems. I will conclude the talk with a summary of future research directions.

Biography: Dr. Tanvir Arafin is currently an Assistant Professor at the Electrical and Computer Engineering Department at Morgan State University, Baltimore, MD. He received his M.S. and Ph.D. degrees in Electrical and Computer Engineering from the University of Maryland, College Park, in 2016 and 2018. Dr. Arafin's research focuses on hardware security and trust issues in emerging computing platforms. Dr. Arafin's work has been published at flagship venues in hardware design and security such as IEEE Transactions on Very Large Scale Integration Systems (VLSI), IEEE Transaction of Computers (TC), ACM International Conference on Computer-Aided Design (ICCAD), and Asia and South Pacific Design Automation Conference (ASP-DAC). He won the IEEE TC Featured Paper of the Month in 2022, the Best Paper award at IEEE AsianHOST in 2018, the Best Paper Nomination in ACM GLSVLSI in 2017, and A. James Clerk School of Engineering Fellowship in 2012. His research is supported by funding and donations from NSF, NSA, NASA-JPL, ARLIS, and Xilinx.