Title: Learning Patterns for Autonomous Control: Towards Data-Efficient AI and Adaptive Decisions

Abstract: As seen in the recent rapid development of generative AI, the number of model parameters for machine autonomy and intelligence is increasing exponentially. Consequently, these operations require enormous amounts of data and high-performance computing (e.g., NVIDIA's Blackwell platform), which will be unsustainable in the long-run due to constraints on power. Our research showed, through paper publications and ongoing work on various concrete applications, that autonomy could be developed more efficiently by classifying patterns in their training data.

This talk will provide a general overview of the work that we have done and are doing towards the ultimate goal of achieving data-efficient AI and control. It includes three main parts: 1) memory-efficient architectures for reinforcement learning, 2) predictive and anti-redundant multisensor fusion , and 3) robust and adaptive planning/control under uncertainties. We demonstrate our work on a diversity of real-world problems including vehicle congestion control, multi-target tracking, and power grid network fault-tolerant control. By optimizing these algorithms by learning patterns, we can establish a more well-rounded approach to autonomy and intelligence as a whole.

Biography: SooJean Han is an Assistant Professor of Electrical Engineering at KAIST and the director of the Autonomous Control for Stochastic Systems (ACSS) research lab. Her research interests lie broadly at the intersection of control theory and AI, particularly in stochastic control, estimation, and decision-making based on efficient learning of a system's spatiotemporal patterns and physical symmetries. Her research spans a broad range of applications including traffic management of unmanned (aerial) vehicles, path-planning, robotic systems and reinforcement learning, and distributed sensor networks.

Prior to KAIST, she completed her Ph.D. in Control and Dynamical Systems at Caltech in Jan. 2023 under the guidance of Professor Soon-Jo Chung and Professor John C. Doyle. She was supported by the Caltech Special EAS Fellowship and the NSF GRFP. She received her B.S. in Electrical Engineering and Computer Science, and Applied Mathematics at UC Berkeley in 2016. She was also a research assistant in the Hybrid Systems Lab at UC Berkeley, and a research affiliate of Team CoSTAR for the DARPA subT Challenge at NASA JPL.