SEMINAR SERIES

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湍流与复杂系统国家重点实验室

BarrierNet: Safe and Stable Robot Learning and Control

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MIT

主持人：孙志勇 李忠奎

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地 点：新奥工学大楼 1008 会议室

Abstract:

Safety is central to autonomous systems/robots since a single failure could lead to catastrophic results. In unstructured complex environments where system states and environment information are not available, the safety-critical control problem is much more challenging. In this talk, I will first discuss safety from a control theoretic perspective with Control Barrier Functions (CBFs). CBFs capture the evolution of the safety requirements during the execution of a control system and can be used to guarantee safety for all times due to their forward invariance. Next, this talk will introduce an approach for extending the use of CBFs to machine learning-based control, using differentiable CBFs that are end-to-end trainable and adaptively guarantee safety using environmental dependencies. These novel safety layers give rise to new neural network (NN) architectures such as what we have termed the BarrierNet. The proposed methods have been applied to various robotic systems, both in simulations and in real robot experiments.

Bio

Wei Xiao is currently a postdoctoral associate at the Computer Science and Artificial Intelligence lab (CSAIL), Massachusetts Institute of Technology. He received his Ph.D. degree from the Boston University, Brookline, MA, USA in 2021. His research interests include safety-critical control theory and trustworthy machine learning, with particular emphasis on robotics and multi-agent systems. He received an Outstanding Dissertation Award at Boston University, an Outstanding Student Paper Award at the 2020 IEEE Conference on Decision and Control, and a Best Paper Nomination at ACM/IEEE ICCPS 2021.

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