From Human Cognition to Ocean

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ABSTRACT:

Human cognition provides a powerful blueprint for developing adaptive artificial intelligence systems that can learn, reason, and act across diverse domains. In this talk, I will first introduce *HiCL*, a hippocampal-inspired continual learning architecture that draws on the complementary learning systems of the brain to mitigate catastrophic forgetting. By leveraging sparse pattern separation, prototype-based replay, and consolidation mechanisms, HiCL enables efficient and scalable acquisition of sequential knowledge. Building on this foundation, I will discuss *Multi-RAG*, a multimodal retrieval-augmented generation framework that integrates video, audio, and text streams to filter vast volumes of information in dynamic, information-rich scenarios, such as military decision support. Finally, I will show how these cognitive principles can be extended to embodied agents in the ocean. The *DREAM* system demonstrates how vision–language reasoning, spatial memory, and domain knowledge can guide autonomous underwater vehicles in long-term exploration tasks such as oyster reef monitoring and shipwreck mapping. Together, these efforts illustrate a unified perspective on cognition-inspired AI: moving from memory-grounded continual learning, to adaptive multimodal reasoning, and ultimately to embodied decision-making in extreme environments.

BIOGRAPHY:

Dr. Xiaomin Lin is an Assistant Professor at the University of South Florida whose research lies at the intersection of robotics, AI, and perception, with a focus on intelligent systems operating in complex and challenging environments. He develops Edge AI solutions and multimodal sensing for applications in underwater, agricultural, and healthcare robotics. He is currently Associate Editor for International Conference on Robotics and Automation (ICRA) and an honored graduate of the University of Maryland's Institute for Systems Research. He was awarded IAA postdoc fellowship at Johns Hopkins University.

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