

From 2D Floorplans to Immersive Worlds: Generative 3D and Video Synthesis for Indoor Environments

A talk by Professor Rui Yu

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ABSTRACT

The ability to automatically generate immersive, three-dimensional indoor environments from simple two-dimensional layouts holds immense potential for fields like virtual reality, interior design, real estate, and robotics. However, translating sparse 2D spatial inputs into geometrically consistent and photorealistic 3D structures or videos remains a significant challenge due to the lack of explicit 3D structure.

In this talk, I will present our recent advancements in bridging this gap through three novel generative frameworks. First, I will introduce Top2Pano, an end-to-end model that synthesizes realistic 360-degree indoor panoramas from top-down views by combining volumetric rendering with diffusion-based refinement. Next, I will discuss Layout-Walker, a two-stage method that pioneers the generation of controllable, first-person-view videos from 2D room layouts by lifting layouts into coarse 3D meshes to guide text-conditioned video synthesis. Finally, I will present Plan2Interior, a framework that converts 2D floorplan images into editable 3D environments and photorealistic walkthrough videos using Vision-Language Models and interactive simulator guidance. Together, these works establish new benchmarks for controllable scene generation and highlight the future of immersive indoor synthesis.

ABOUT THE SPEAKER

Dr. Rui Yu is an Assistant Professor in the Department of Computer Science and Engineering and the Louisville Automation & Robotics Research Institute (LARRI) at the University of Louisville. His research lies at the intersection of Artificial Intelligence and Human-Computer Interaction, with a strong focus on computer vision, machine learning, multimodal LLMs, and intelligent interactive systems.

He received his Ph.D. in Information Sciences and Technology from Pennsylvania State University and holds MSc and BSc in Automation from Tsinghua University. Prior to his academic appointment, Dr. Yu gained industry research experience as an intern at Snap Research, Kitware, and Toyota Research Institute. His recent work has been recognized with the Best Student Paper Award at ECML-PKDD 2025 and NVIDIA Academic Grant Award in 2025.