



University Seminar Series: **GW** Robotics, Artificial **I**ntelligence (AI),  
and **T**ransportation for **S**mart Health & Smart Cities (**GRITS**)

***Hardware Design and Control Algorithms for Agile and Versatile Legged Robots***

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Biological animals excel at navigating complex and challenging environments, leveraging their hardware to perform dynamic motions and athletic skills that overcome diverse obstacles. Despite recent advancements, robotic systems still lack comparable dynamic locomotion capabilities. In this talk, I will present our lab's efforts to bridge this gap by developing robust hardware and effective control algorithms that enable both agility and robustness in legged robots. I will begin by introducing our quadruped robot platforms: **HOUND**, designed for high-speed locomotion on complex terrains, and **MARVEL**, designed for agile and versatile climbing. **HOUND** incorporates custom electric actuators, while **MARVEL** uses magnetic feet to generate climbing force. I will then discuss the control algorithms that drive these robots, leveraging model predictive control and reinforcement learning techniques. Finally, I will present our latest learning-based locomotion control framework, capable of synthesizing and executing diverse dynamic motions across various terrains. This framework combines a low-level skill policy, pre-trained using a large offline dataset generated via trajectory optimization, with a reinforcement learning policy trained on diverse terrains. With this integrated approach, **HOUND** achieves speeds of up to **9.5 m/s**, making it the **fastest legged robot**, while **MARVEL** can traverse ceilings and vertical walls at speeds of up to 0.5 m/s and 0.7 m/s, respectively.



Prof. Hae-Won Park is the director of the Humanoid Robot Research Center and an Associate Professor of Mechanical Engineering at KAIST. He received his B.S. and M.S. from Yonsei University and his Ph.D. from the University of Michigan, Ann Arbor. Before joining KAIST, he was an Assistant Professor at the University of Illinois at Urbana-Champaign and a postdoctoral researcher at MIT. His research focuses on learning, model-based control, and robotic design, especially in legged and bio-inspired robots. Prof. Park has received several prestigious awards, including the *NSF CAREER Award* and the *RSS Early-Career Spotlight Award*, and serves on editorial boards for top robotics journals and conferences such as *IJRR* and *IEEE ICRA*.

**Wednesday, December 11th, 2024**  
**12:30 p.m. – 1:30 p.m. (Pizza will be served)**