

Richard (Han) Hu

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Experiences

PX Robotics

Jan. 2022 - Present

Senior Machine Learning Engineer, Motion Control Center

- **Innovation** Spearheaded reinforcement learning based biomimetic gait and locomotion projects by improving on SOTA algorithms. Exceeded SOTA methods on all metrics. Achieving 1.5x better disturbance rejection, doubling maximum velocity, and generalization to unseen rough terrains and tasks. Current have 2 patents pending.
- **Process Optimization** Formulated an analytical approach to reinforcement learning training, slashing model iterations by up to 70%.
- **Research** Analyzed SOTA machine learning methods for quadruped control, large language models, manipulators, and embodied AI, provides insight on departmental product strategy.
- **Infrastructure** Revamped the reinforcement learning pipeline using a modular design, removed all manual. Led the development of MLOps tools, including cloud model sharing, test automation, and data collection and analysis, reducing manual tasks by 80%.

Autonomous System and Biomechatronics Lab

Sep. 2018 - Aug. 2021

Developer, Master Thesis

- **Deep Learning** Led the development and **published** a novel sim-to-real pipeline for end-to-end reinforcement learning rough terrain navigation policy in Pytorch. Achieved 87% real world success rate, 90% simulation success rate; 72% increase against benchmarks.
- **Development** Developed a distributed software and hardware robot system using ROS, C++, Python, and SolidWorks. System included simulator, LiDAR and VIO SLAM, position controller, hardware driver, reinforcement learning training and deployment framework, 3D reconstruction module, sensor interfaces, and teleoperation.
- **Publication** Published in 1) IEEE Robotics and Automation Letters 2021 and 2) IROS 2021 Conference.

Huawei Noah's Ark Lab

May. 2020 - Jan 2021

Developer, Autonomous Driving Division

- **Path Planning** Developed, **published**, and **patented** a novel Delaunay Triangulation based spatial constraint generation algorithm for mapless autonomous vehicle navigation in a dynamic environment. Achieved 18% increase in navigation success rate and 28% increase in valid plans compared to existing methods.
- **Simulation** Engaged in simulator development using CARLA by automating map generation process from real-world datasets.
- **Publications** Published in 1) IROS 2021 Conference and 2) US Patent Application No. 17/515,522.

Publications

A Sim-to-Real Pipeline for Deep Reinforcement Learning Autonomous Navigation in Cluttered Rough Terrain

Hu. H, Kaicheng Zhang, Aaron Hao Tan, Michael Ruan, Christopher Agia, and Goldie Nejat

RAL and IROS2021

- Proposed a pipeline to transfer challenging rough terrain navigation policy from simulation to the real-world using high fidelity simulation, abstract observation space, and domain randomization.
- The pipeline achieved a 87% real world navigation success rate given a 90% simulation success rate.
- The pipeline has up to 72% increase in navigation success along with a faster travel time and shorter distance against existing methods.

Spatial Constraint Generation for Motion Planning in Dynamic Environments

Hu. H, Peyman Yadmellat

Patent and IROS2021

- Proposed to generate spatial constraint using triangulation mesh for long-term mapless path planning in a dynamic environment.
- Overcame the static triangulation mesh assumption and the object masking issue of existing methods.
- Achieved up to 18% increase in navigation success rate and up to 28% increase in valid plans compared to existing methods.

Education

University of Toronto

Toronto, Canada

Master of Applied Science, Mechanical Engineering

Sep. 2018 - Aug. 2021

- **Specialization** Deep Reinforcement Learning, Machine Learning, Mobile Robotics; GPA (4.00/4.00)

University of Toronto

Toronto, Canada

Bachelor of Applied Science, Mechanical Engineering

Sep. 2013 - Apr. 2018

- **Specialization** Robotics and Mechatronics Minor; Dean's Honor List for all terms; GPA (3.81/4.00)