Richard (Han) Hu

(647) 995-9055 | rhklite2012@hotmail.com | rhklite.github.io | rhklite

Experiences

Autonomous System and Biomechatronics Lab *Sep. 2018 - Aug. 2021*

Developer, Master Thesis

- **Deep Learning** Led the development and **published** a novel sim-to-real transfer pipeline for rough terrain navigation in Pytorch
- **Sim-to-Real** Researched, designed, and implemented a high fidelity Gazebo simulator and domain randomization
- **Development** Developed a decentralized software and hardware robot architecture using ROS, C++, and Python
- **Analysis** Led real-world navigation, comparison, and ablation experiments to demonstrate that the pipeline achieved 87% real world success rate given a 90% simulation success rate; up to 72% increase against existing methods
- **Hardware** Enhanced a robot with auxilliary computing units and sensors with components designed using SolidWorks

Huawei Noah's Ark Lab *May. 2020 - Jan 2021*

Developer, Autonomous Driving Division

- **Path Planning** Developed, **published**, and **patented** a Delaunay Triangulation based spatial constraint generation algorithm for mapless autonomous vehicle navigation in a dynamic environment
- **Development** Implemented a Python based path planning simulator and the algorithm's modules for fast development iterations
- **Algorithms** Implemented Hybrid A* and Funnel algorithm for path planning in triangulation mesh
- **Simulation** Engaged in simulator development using CARLA by automating map generation process from real-world datasets

Water and Energy Research Laboratory *Jan. 2018 - Sep. 2018*

Developer, Pico-Scale Hydro Turbine Design

- **Mechanical** Designed and published a variable guide vane for pico-scale hydro turbine using SolidWorks
- **Analysis** Evaluated the guide vane failure mode with fluid pressure test, mechanical stress test, and finite element analysis
- **Development** Prototyped the turbine and an experiment pipeline using Arduino, SLA 3D printing and machining techniques

Publications

A Sim-to-Real Pipeline for Deep Reinforcement Learning Autonomous Navigation in Cluttered Rough Terrain (RAL, IROS2021)

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

- 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 acheived a 87% real world navigation success rate given a 90% simulation success rate
- The pipline 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 (IROS2021, Huawei Patent)

Hu. H, Peyman Yadmellat

- 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 that existing methods have
- Achieved up to 18% increase in navigation success rate and up to 28% increase in valid plans compared to existing methods

Optimization and System Identification of a Variable Pico-Scale Hydro Turbine for Pressure Regulation (ASME2021)

Yu. SM, Ko. Y, **Hu. H**, Seo. J, and Bilton. AM

- Engaged in the design and prototyping of the turbine and its experiment rig using SolidWorks, machining, and 3D printing

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)