

ZHEN HAO GAN

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EDUCATION

Nanyang Technological University (NTU), Singapore

Aug 2017 – Jun 2021

Bachelor of Engineering (Electrical and Electronic Engineering)

- **CGPA:** 4.80/5.00, Honours (Highest Distinction)
- Advisor: Prof. Xie Lihua

Technical University of Munich (TUM), Munich, Germany

Oct 2019 – Mar 2020

Student Leader, Winter Semester Exchange (Fakultät für Elektrotechnik und Informationstechnik)

- Postgraduate Module: (1) Computational Intelligence (2) Broadband Communication Network (3) Principle in Electrotechnology (4) Computer Architecture and Network

RESEARCH INTERESTS

Embodied Navigation with Skills Adaptation under different Morphologies & Kinodynamics |

Reinforcement Learning in Motion Planning | 3D Path & Motion Planning in Unknown-Unstructured Environments |

Autonomous Strategy Selection with Kinodynamic Feasibility | Legged & Humanoid Robots

PUBLICATIONS

- [1] **Zhen Hao Gan**, Y. You, and M. Y. Chuah, “Navigation with tactile sensor for natural human-robot interaction,” 2022. *in submission*.
- [2] Y. C. Ng, Q. Wen, Lim, C. Y. Tan, **Zhen Hao Gan**, and M. Y. Chuah, “Tactile aware dynamic obstacle avoidance in crowded environment with deep reinforcement learning,” 2024. *in submission*.

RESEARCH EXPERIENCE

3D Terrain Reconstruction with Semantic Information, I^2R , A*STAR

Jul 2023 – Present

Robotics Research Engineer, advised by Dr. Michael Chuah

- Proposed ideas on 3D Reconstruction of Point Cloud based on semantic information of terrains to improve on traversability performance and generalize to more complicated outdoor terrains.
- Developing high speed, low computation cost 3D Terrain Reconstruction Module with Semantic Information for accurate representation of terrain in real-life.
- Eliminate noisy raw input and fill missing data in scenarios like tall grasses and grates to avoid rogue locomotion and smoothen behavior when compared to previous work.
- Enable legged robots to respond correctly on the terrains with the reconstruction module.

Real-Time Dynamic Probing Framework for Legged Robots, I^2R , A*STAR

Jul 2023 – Present

Robotics Research Engineer, advised by Dr. Michael Chuah

- Investigate the feasibility of providing collapsibility and terrain information through the usage of legs on legged robots for real-time dynamic probing on suspicious terrains.
- Developing a framework to incorporate the real-time digital double for collapsibility estimation and subsequently provide feedback on terrain information using dynamic probing capabilities.
- Developing Path and Motion Planner based on the framework to avoid dangerous terrain and achieve safe legged robot navigation in unstructured-uneven terrains.

Navigation with Tactile Sensor for Natural Human-Robot Interaction, I^2R , A*STAR Dec 2020 – Jun 2021

Robotics Research Engineer, advised by Dr. You Yangwei & Dr. Michael Chuah

- Investigate the use of tactile sensors in robotic navigation stack and propose new social navigation stack with tactile sensors.
- Developed social robotic navigation stack for human-crowded environments with tactile sensors, RGB camera & LiDAR.
- Completed robot with social navigation abilities: proximity filter compliance control, active social interactions, and passive social interactions using force responses, dynamic cost assignment and semantic segmentation.
- Built semantic layers for robots to behave with socially acceptable reactions by both semantic & force information.
- Implemented compliance control based on APF for fast and reliable response to collisions.

Vision-based Robot Navigation via Deep Reinforcement Learning, NTU

Jul 2020 – Jun 2021

Final Year Project, advised by Prof. Xie Lihua

- Developed visual perception module for pedestrian identifier using YOLOv4.
- Built and tested *DRL-Based Autonomous Navigation* through Python to fuse camera data and GA3C- CADRL for AGVs navigation in pedestrian-rich environment using ROS-Gazebo Simulation.
- Create and test *Pedestrian Interaction Module* by inferring pedestrians location together with Collision Avoidance System for DRL navigation using PyTorch.
- Achieved >80% success rate when navigating around 10 human obstacles in a small area.

PROFESSIONAL EXPERIENCE

Robotics Research Engineer, *I²R*, A*STAR

Sep 2021 – Present

supervised by Dr. Michael Chuah & Dr. Albertus Hendrawan Adiwahono

◦ Project Rover-X:

- Developed and implemented GPS Goal-driven Exploration Module to allow the legged robot explore and approach its goal in unmapped areas while avoiding obstacles.
- Developed and implemented Traversability Analysis and Traversability Interpreter modules to explore in unmapped areas while navigating treacherous terrains such as kerbs and stairs.
- Developed Dynamic Gait Switching Module and implemented A*STAR Navigation Stack to control and overcome uneven terrains in autonomous mode for Rover-X.
- Successfully delivered D6 demo for fully autonomous patrolling and people following capabilities to HTX & SCDF with replacement of human operators in high-risk HazMat operations. [Featured at Straits Times](#).

◦ Project 5G-CosMo:

- Developed and implemented a perception module on elevation mapping for terrain features.
- Developing legged robot motion planning module with perception locomotion to enable navigation in a challenging construction environment and terrain.

◦ Semantic Navigation R&D:

- Developed tactile and semantic based navigation module for robots to behave naturally in human-dense environments.
- Developed Inverse Temporal Layer for better and natural performance in social navigation.
- Improved Semantic Inflation Layer to incorporate arbitrary cost value of obstacles and subsequent inflation by radius.

HONOURS & AWARDS

- **2024:** A*STAR National Science Scholarship (NSS-PhD, 5-yr funding for Ph.D. study)
- **2019:** NTU EEE Partial Financial Award for GEM Explorer
- **2019:** Dean List's Academic Year 2018/2019 (Top 5% of the Cohort)
- **2018:** Dean List's Academic Year 2017/2018 (Top 5% of the Cohort)
- **2017:** GCE A-Level High Achiever Award (4A*)
- **2017:** Silver Medal – Kangaroo Maths Competition (KMC)
- **2017:** Distinction – Euclid Contest
- **2016:** Distinction – Euclid Contest
- **2016:** Distinction – Australian Maths Competition (AMC)
- **2016:** Sunway College Special Scholarship

INTELLECTUAL PROPERTY / PATENTS

- Palanivelu Hari Prasanth, **Gan Zhen Hao**, Shervina Lim Qi Wen, Ng Yung Chuen, Michael Chuah Meng Yee, Albertus Hendrawan Adiwahono, "Perception Locomotion for Quadrupedal Robots using non-linear Model Predictive Control", *SWIP-PLQR-2023-29*, A*STAR
- Palanivelu Hari Prasanth, Garen Haddeler, Ng Yung Chuen, **Gan Zhen Hao**, Shervina Lim Qi Wen, Michael Chuah Meng Yee, Albertus Hendrawan Adiwahono, "A Novel Real-time Digital Double to Estimate Collapsible Terrains for Legged Robots", *SWIP-ND2R-2023-30*, A*STAR

LEADERSHIP & CO-CURRICULAR ACTIVITIES

37th EEE Club Management Committee, NTU

Aug 2018 – Aug 2019

Honorary Treasurer

- Spearheaded an internal reformation of EEE Club in finance department.
- Established a more structured procedure in processing finance of EEE Club.
- Strategized over \$18,000 budget and maximize performance of annual events by EEE Club.

Blockchain@NTU, NTU

Oct 2018 – Aug 2019

Co-Business Development Director

- Lead team of 16 in contacting potential partners for event collaborations or research grants.
- Establish over 10 connections worldwide for partnership and collaboration.
- Maintain quality of existing Blockchain @ NTU partnership and sponsorship network.

RELEVANT COURSES

- Coursera Relevant Modules: (1) Deep Learning Specialization (2) Computer Vision (3) Reinforcement Learning Specialization (4) Self-Driving Cars Specialization (5) Machine Learning
- Udemy Relevant Modules: (1) Complete Self-Driving Car Course – Applied Deep Learning

SKILLS

Languages:

English, Chinese (Mandarin), Malay, German

Programming Languages:

C/C++, Python, Java, MATLAB

Softwares and Libraries:

ROS & ROS2, Gazebo, Isaac Lab & Sim, PyTorch, TensorFlow, Git & Github