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EXPERIENCE

Delta-NTU Corporate Laboratory, Nanyang Technological University (NTU)

Singapore

Robotics Research Engineer

Dec 2023 – Present

- Responsible for robotics integration of three NTU Professor-led research projects collaborated with Delta Electronics:
 - Hyper-redundant soft-rigid robotic gripper* led by Prof. Guo Zhan Lum
 - Printed, flexible tactile sensors* led by Prof. Wei Lin Leong
 - Haptic-based learning for in-hand and dual-arm manipulation* led by Prof. Domenico Campolo
- Developed robotics manipulation systems based on research outcomes and applied for corporate's industrial applications
- Collaborated with Delta Electronics's team in actuators and sensors development for their next generation mobile robot

Orion Astropreneur Space Academy (Hong Kong) Ltd.

Hong Kong

Educational CubeSat Developer & Course Instructor

Jul 2022 – Jun 2023

- Initiated a flagship CubeSat program for the company to educate young students about space science and technology
- Conducted studies in CubeSat's Attitude Determination and Control Systems (ADCS) and deployment mechanisms
- Designed a compact and full-scale CubeSat with onboard camera, reaction control, and deployable solar panels
- Developed the CubeSat software for wireless control and live stream with IoT microcontrollers on custom-designed PCB
- Improved the CubeSat prototype for mass production and produced 50+ educational CubeSat DIY kits
- Spearheaded a team of five STEM instructors for delivering a 12 hours CubeSat course in PolyU and HKPC

Robotic Manipulation Lab, HKUST Robotics Institute

Hong Kong

Robotics Researcher

Feb 2019 – Aug 2022

- Published two research articles in RA-L and one research paper in ICRA, which are the top and most prestigious journal and conference in the robotics and automation community
- Developed High-Speed Scooping, a highly successful method of rapid thin object picking by using a direct-drive gripper
- Built a robotic gripper with palmar actuation and asymmetric finger motion for in-hand manipulation
- Developed an RRT*-based planning algorithm for robotic insertion and placement with a two-fingered gripper
- Conducted experiment to evaluate the robustness of applications in robotic battery insertion and Go stone placement
- Designed a ground-based mobile robot for transporting heavy objects with Rock-and-Walk manipulation
- Conducted a simulation in Gazebo of using a robot arm to analyze the trajectory of Rock-and-Walk motion

HKUST Robotics Team

Hong Kong

Mechanical and Software Engineer

Dec 2017 – May 2020

- Closely collaborated with hardware team to build and develop a compact two-wheel balance robot for racing
- Implemented a control algorithm for the two-wheel balance robot to stabilize attitude at high speed of 1.5m/s
- Designed a small-scale bipedal robot with single-board computer and depth camera for automation
- Performed torque optimisation and stability analysis in MATLAB simulation for stable bipedal locomotion

EDUCATION

The Hong Kong University of Science and Technology (HKUST)

Hong Kong

MPhil in Electronic and Computer Engineering | GPA: 3.86/4.3

Sep 2020 – Aug 2022

- Thesis: *Towards Versatile Robotic Manipulation: From High-Speed Picking to Dexterous Placing* (advised by Dr. Jungwon Seo)
- Course work: Robotic Manipulation, Aerial Robotics, Control Theory, Computer Vision, Deep Learning

The Hong Kong University of Science and Technology (HKUST)

Hong Kong

BEng in Mechanical Engineering, Minor in Robotics (First Class Honors) | GPA: 3.75/4.3

Sep 2017 – May 2020

- Final year project: *Gecko-Inspired Adhesive Robotic Gripper* (advised by Dr. Michael Yu Wang)

PUBLICATIONS & PATENTS

- **K. H. Mak**, P. Xu and J. Seo, "High-Speed Scooping: An Implementation through Stiffness Control and Direct-Drive Actuation," in 2023 IEEE International Conference on Robotics and Automation (ICRA), 2023, pp. 10261-10267.
- **K. H. Mak**, P. Xu, D. C. Y. Wong, H. Yu, and J. Seo, "Method for Robotic High-Speed Scooping Manipulation," U.S. Provisional Application 63/312101 & Chinese Patent Application CN202211509167.1, filed 29 Nov 2022.
- **K. H. Mak**, C. H. Kim, and J. Seo, "Robust Ungrasping of High Aspect Ratio Objects Through Dexterous Manipulation," in *IEEE Robotics and Automation Letters*, vol. 7, no. 2, pp. 2843-2850, April 2022.
- C. H. Kim, **K. H. Mak**, and J. Seo, "Planning for Dexterous Ungrasping: Secure Ungrasping through Dexterous Manipulation," in *IEEE Robotics and Automation Letters*, vol. 7, no. 2, pp. 2234-2241, April 2022.

SKILLS

- **Languages:** English (Native), Cantonese (Native), Mandarin (Conversational)
- **Programming Languages:** Python, C++, MATLAB, HTML, JavaScript, LaTeX
- **Programming Frameworks:** Linux, ROS, Pytorch, Tensorflow, OpenCV, Gazebo, STM32
- **Design Software:** SolidWorks, Fusion360, Altium Designer, Adobe Photoshop, Adobe Illustrator, DaVinci Resolve
- **Hardware:** Rapid prototyping, 3D printing, Robot arm control, BLDC motor control, PCB design and soldering
- **Others:** Photography, Squash, Table Tennis, Hiking

PRESENTATIONS

- IEEE International Conference on Robotics and Automation (ICRA) 2023, London** May 2023
- Poster Presentation: "High-Speed Scooping: An Implementation through Stiffness Control and Direct-Drive Actuation"
- Robotics: Science and Systems (RSS) 2022 Workshop, New York City** Jul 2022
- Workshop Title: The Science of Bumping Into Things: Towards Robots That Aren't Afraid of Contact
 - Poster Presentation: "High-Speed Scooping Manipulation Using Controlled Compliance"
- IEEE International Conference on Robotics and Automation (ICRA) 2022 Workshop, Philadelphia** Jun 2022
- Workshop Title: Compliant Robot Manipulation: Challenges and New Opportunities
 - Oral & Poster Presentation: "High-Speed Scooping Manipulation Using Controlled Compliance"
- IEEE International Conference on Robotics and Automation (ICRA) 2022, Philadelphia** Jun 2022
- Oral Presentation: "Robust Ungrasping of High Aspect Ratio Objects Through Dexterous Manipulation"
- HKUST Technology Review Committee Meeting** Apr 2022
- Patent Application Review of invention: "Method for Robotic High-Speed Scooping Manipulation"

AWARDS

- 5th ROBO-ONE Auto: 1st Runner-up & Dynamizer Award** Yokohama, Japan
- Designed a humanoid robot for autonomous fighting aimed to recognize and knockdown opponents Sep 2019
- Korea International Robot Contest 2018: 2nd Runner-up in Autonomous Humanoid Walking** Seoul, Korea
- Implemented an autonomous system on a humanoid robot with visual feedback for track following Oct 2018
- The NXP Cup Intelligent Car Racing 2018: Second Class Award in Magnetic Balance group** Xiaogan, China
- Built and programmed an autonomous balance robot to complete a racing track with magnetic line beneath Jul 2018