Ruotong Jia (Rico)

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EDUCATION

- *Master of Science in Robotics,* **Northwestern University, Evanston, IL, USA,** *3.73 /4.0*   **December 2020**
- *Bachelor of Applied Science in Electrical Engineering,* **University of British Columbia, Vancouver, BC, Canada**   **May 2019**

SKILLS

- **Programming: C, C++, Python, MATLAB, Excel VBA, Version Control, Linux, Build System**
- **Robotics: ROS, Rethink Intera, Motion Planning, SLAM, PyTorch, PyBullet, Moveit!, Navigation Stack**
- **Electrical Engineering: Control Systems, Signal Processing, Power Electronics, TCP/IP, Microchip PIC, Arduino,**
- **Coursework: Machine Learning, Computer Vision, Robot Navigation, Kinematics, Multi-threading, Mechatronics**
- **Languages: Fluency in English and Mandarin, conversational Spanish**

WORK EXPERIENCE

Robot Navigation Intern | *Shirley Ryan AbilityLab, Northwestern University, USA*   **June 2020 - Present**

- Independently designed and developed FasTrack, a cutting-edge optimal-control based motion planning scheme on a highly modularized, multi-threaded ROS plugin framework, resulting in a 0 collision rate and safe dynamic speed switching
- Implemented a high-performance motion planning stack for a smart wheelchair, with four fine-tuned ROS navigation stack planner alternatives and two Search-Based-Planning (SBPL) planners, resulting in a 0 collision rate and smooth robot motions
- Set up a test framework and implemented an automatic gmapping node for building the global map of a Gazebo environment

Research Intern | *National Laboratory of Robotics, Tecnológico de Monterrey, Mexico*   **May - July 2018**

- Built a well-functioning main PCB of a micro UAV, as well as the communication chain between the ground station, PIC32 microcontroller, and Sensor Network using Telnet (TCP/IP), Serial Communication, I2C protocols
- Developed noise reduction algorithm that effectively reduces barometric altitude sensor noise by 2.7dB in SNR ratio, using impedance matching and a first order low-pass filter
- Assisted with dynamics simulation on SIMULINK for Sliding-Mode controller design using Newton-Euler's Approach

Engineering Co-op Student | *EWOS CANADA, CARGILL INC., Surrey, Canada*   **September 2017 - May 2018**

- Actively led, managed, and coordinated multiple industrial energy conservation projects that resulted in $10000 annual savings, including air leak repair, compressed air system upgrade, and pneumatic valve replacement
- Surveyed plant motors for updated power rating, power factor and frame size and updated one-line MCC diagrams
- Independently proposed and developed an Excel VBA software for data entry, resulting in 400h/year time saving
- Provided technical support to QA lab including testing and sample management

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TECHNICAL PROJECTS (*Video Demonstrations:* https://ricojia.github.io/)

Multi-Agent Delta Arm Simulator & Control   **September 2020 - Present**

- Developed a 1:1 closed-chain delta robot simulator on PyBullet from scratch for dynamics simulation using Python. Key features include an accurate kinematic and dynamic configuration of the robot, serial-elastic actuators for force control, a Moveit! action interface and other test interfaces. Correctness of the model has been verified using Lagrange Dynamics methods.
- Built a Moveit! control package (C++), equipped with a customized IK solver and a cleverly serialized parallel manipulator URDF robot configuration.
- Building a fast, collision-free multi-agent Moveit! planning pipeline for three Delta Arms mounted on mobile bases.

Delta Arm Trampoline Using Deep Learning   **October 2020 - Present**

- Building a fun "trampoline" that bounces a ball as long and high as possible. The trampoline is implemented on a Delta Arm that is equipped with a Deep Neural Network using Deep Deterministic Policy Gradient (DDPG)

The Coffee Bot From Scratch   **September 2020 - Present**

- Built a reliable differential drive tank robot for indoor coffee delivery from scratch, including mechanical structure & drive system, a 3D-printed cup holder, camera live stream, adaptive motor control, and a teleoperation interface on Raspbian using SSH
- Achieved high localization accuracy and planning efficiency with fine-tuned AMCL SLAM, SBPL Lattice Planner, DWA ROS packages, alongside with a well calibrated 2D LIDAR and IMU
- Implemented a highly robust adaptive motor controller with Hall-Effect wheel encoders

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Smart Watch Prototype (https://github.com/RicoJia/ME433_Advanced_Mechatronics)   **April 2020 - June 2020**
- Built a fun smartwatch prototype with accurate time, motion sensing, a capacitive touch sensing pad. The prototype was built on top of a PIC32 microcontroller, with an OLED screen display with SPI, addressable LED control, an IMU with I2C, and a custom aluminum capacitive touch pad

Motion Planning Packages (https://github.com/RicoJia/Motion_Planning_Rico**)**   **March 2020 - Present**
- Implemented a full 2D motion planning stack from scratch using C++ on ROS with STL and basic ROS messaging framework. Features include maps (PRM, Grid Maps), global planning algorithms (A*, Theta*), global incremental planning algorithms (LPA*, D* Lite), DWA, and control (MPC) packages for Turtlebot 3 Burger in a virtual room

Robust Visual SLAM Survey (https://ricojia.github.io/**)**   **January 2020 - March 2020**
- Extensively Researched and analyzed core techniques used in feature extraction, feature matching, motion segmentation, localization, and 3D reconstruction

Landmark-Based SLAM Simulator (https://ricojia.github.io/ **)**   **January 2020 - March 2020**
- Developed a lightweight landmark-based SLAM simulator in C++ and Python comprising: a differential drive kinematics model, landmark observations from a simulated laser scanner detector, and a robot navigation node with known-correspondence Extended Kalman Filter (EKF)
- Built feature association for cylindrical landmark recognition with 97% accuracy using circular regression

Robot Artist (https://ricojia.github.io/ **)**   **December 2019**
- Developed an efficient Depth-First-Search based path planning algorithm for drawing on letter-size paper
- Built a robust linear trajectory motion planner and a force controller for Rethink Sawyer robot with Intera's Inverse Kinematics tools (ROS Python)

Rover for Outdoor Log Inspection (https://ricojia.github.io/ **)**   **April 2019**
- Implemented Phiget1040 GPS Driver Module in ROS C++, and a linear Kalman Filter for localization for fusing IMU, GPS, and Ultrasonic Data
- Designed a motor controller on driving wheels for rough terrains using state-space control techniques

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DESIGN TEAM & COMPETITION EXPERIENCE

UBC Biomedical Imaging and Artificial Intelligence (BMIAI) Hackathon - *3rd Place*   **November 2018**
- Implemented Natural Language Processing (NLP) on Tweets for sentiment analysis using Google TensorFlow in Python 3.7, achieving 76.4% accuracy with 1000 features

UBC Sustaingineering - *Captain*   **July 2016 - May 2018**
- Led a team of 13 highly talented engineering students on sustainability projects, including workshops, team-building activities, and fund-raising events
- Designed an efficient Perturb & Observe (P&O) MPPT algorithm for a 6V-12V pico standalone solar system on Simulink, later implemented the controller in a Reverse-Buck DC-DC Converter topology
- Initiated and supervised a Wireless Solar Pump Data Transmission System Project for developing communities in Nicaragua
- Implemented an Arduino-3G communication channel for solar pump's wireless data transmission with its control computer

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HOBBIES & INTERESTS
- Weightlifting and Fitness
- Learning Languages
- Singing
- History & Cultures