Broderick Riopelle

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EDUCATION

University of Michigan   **Aug. 2020 – May 2024**
Bachelor of Science in Computer Engineering   *Ann Arbor, MI*

EXPERIENCE

Robotics Engineer   **May 2024 – Present**
University of Michigan   *Ann Arbor, MI*

- Designed and built the Robot Interprocess eXchange (RIX), a robot operating system modeled after ROS to support undergraduate robotics education.
- Maintained large-scale software projects by creating modular, testable interfaces and integrating unit testing frameworks for reliability and automated grading.
- Mentored multiple intern teams across two summers, guiding projects from concept through implementation in robotics software and firmware.

Low-Speed Autonomy Intern   **May 2023 – Aug. 2023**
Ford Motor Company   *Dearborn, MI*

- Engineered a high-performance data pipeline for surround view camera systems, enabling efficient neural network training and validation.
- Leveraged multi-threading to accelerate image decompression and transformation for concurrent processing.
- Optimized color correction algorithms in Python using vectorized DSP techniques, significantly improving computational efficiency.

Student Researcher   **Jan. 2023 – Dec. 2023**
Retrospect Technologies   *Ann Arbor, MI*

- Partnered with Perot-Jain TechLab at MCity to evaluate and quantify autonomous vehicle risk metrics.
- Designed high-risk driving scenarios for experimental validation at the MCity test facility.
- Collected and analyzed RTK-GPS data from autonomous vehicles using Dataspeed NavRoute to provide empirical support for risk assessments.

Software Engineering Intern   **May 2022 – Apr. 2023**
Link Engineering   *Plymouth, MI*

- Enhanced database platform by integrating Python script uploads with IronPython, enabling customer-driven analytics.
- Built a TypeScript linear algebra library optimized for computer graphics applications.
- Developed a flexible API to convert CSV files into Link's data format, expanding usability across diverse datasets.

Instructional Aide   **May 2021 – Apr. 2024**
University of Michigan   *Ann Arbor, MI*

- Developed features for mobile robot APIs, enabling students to implement SLAM, motion planning, and computer vision algorithms.
- Designed MCU-based PCBs to reduce robot costs and offload processing to the cloud, with supporting firmware for sensor integration (LiDAR, cameras, IMUs, encoders).
- Supported instruction in the HelloRob course across University of Michigan, Berea College, Morehouse College, and Howard University.

PROJECTS

Wireless Robot Telemetry   Oct. 2023 – Apr. 2024
- Developed an embedded real-time host controller in C using FreeRTOS and ESP-IDF for managing multi-robot communication over WiFi (TCP/IP) and USB serial interfaces
- Engineered a custom message routing layer to transport messages between a PC via USB and multiple robot clients using ring-buffered queues and non-blocking socket logic
- Implemented a WiFi access point server with dynamic client handling, supporting up to 8 robot connections, with robot ID tracking and connection lifecycle management
- Integrated support for manual control via analog joystick, encoding real-time velocity commands (twist messages) to selected robot clients in pilot mode

Real-Time Signed Distance Fields   March. 2023 – Apr. 2023
- Extended state-of-the-art iSDF neural mapping algorithm by integrating it with the Fetch mobile robot to enable real-time 3D environment reconstruction.
- Designed and implemented ROS integration by modifying ORB-SLAM3 and iSDF nodes to process synchronized RGB-D and IMU data from Fetch's onboard sensors.
- Conducted experiments comparing incremental vs. non-incremental training on ReplicaCAD and Fetch datasets, demonstrating feasible real-time performance despite CPU-only limitations.
- Analyzed SDF error and collision cost metrics, replicating iSDF's trends under constrained hardware and validating the method's scalability to physical robot deployments.

3D Semantic Segmentation   Apr.. 2023
- Implemented UNet and ENet neural network architectures with PyTorch for semantic segmentation of RGB-D images.
- Compared performance of networks trained with and without depth information from NYUv2 dataset.
- Achieved accuracy improvements (ENet from 53.86% to 58.33% and UNet from 50.64% to 57.57%) by incorporating a depth channel into the training data.

Smart Home Air Vent   Oct. 2022 – Dec. 2022
- Designed a motorized floor register to optimize air flow in home for energy efficiency.
- Designed a user-friendly LCD touch screen interface for adjusting temperature settings, furnace state, and monitoring peripheral temperatures.
- Implemented a custom low-latency wireless protocol supporting up to 16 peripheral devices.

TECHNICAL SKILLS

Systems & Low-Level Programming: C, C++, Rust, Linux, PCB Design
High-Level Programming: Python, JavaScript, TypeScript, C#, MATLAB
Data & Robotics: SLAM, Computer Vision, GPU Programming, Digital Signal Processing
Tools & Middleware: FreeRTOS, ROS/ROS2, LCM, Docker, Git, Fusion360, Solidworks, KiCad