Rahul Mitra

MCS 117G, 111 Cummington Mall, Boston, MA 02215 | rahulm@bu.edu | +1 206 751 7697
rahulmitra.xyz | rahul-mitra13 | rahul-mitra13

EDUCATION

Boston University: Ph.D. in Computer Science, advised by Edward Chien — Sep 2021 - Present
Research Interests: Computer Graphics/Geometry Processing & Digital Fabrication

Trinity College: B.S. Computer Science (Hons.) & Physics (Hons.), Research Advisor: Kevin Huang — May 2021
Research Interests: Robotic Teleoperation, Evaulating Haptic Interfaces, Contact Sensing
GPA: 3.95/4.0, *Summa Cum Laude, Phi Beta Kappa inductee, Class of 2021's President's Fellow in Physics*

EXPERIENCE

Graduate Research Assistant, Boston University Department of Computer Science — Sep 2021 - Present
- Implementing geometry processing techniques to solve problems in meshing for computational knitting.
- Involves aspects from non-convex optimization, topology and computational fabrication.

Real-time Object Detection Aid for the Visually Impaired, (undergrad. CS senior thesis) — Sep 2020 - May 2021
- Built white cane, enhanced with a microcomputer, to identify objects and provide audio feedback in real-time.
- Configured Jetson Nano high-performance microcomputer for object identification using a trained model.
- Developed iOS application for audio feedback and seamless interfacing between user and enhanced white cane.
- Winner of best thesis award based on completeness, technical maturity and relevance.

Researcher, Perceptual Robotics and Automation (PandA) Lab, Trinity College — Dec 2018 - May 2021
- *Vibration-based Contact Sensing:* Designed and implemented a Vibration-based Contact Sensor. Wrote code in C and Python to interface sensor with a Raspberry Pi. Resulted in research paper accepted at IEEE ICMRA, 2020. [Pub. 1]
- *Vision-based force-feedback in RMIS:* Examined deviation of haptic feedback from ground truth for acceptable performance in Robot-Assisted Minimally Invasive Surgery (RMIS). Developed models for node-to-node interaction in simulated tissue surface. Resulted in research paper published at IEEE EMBC, 2020. [Pub. 2]
- Haptic Interface for Robot Locomotion: Developed software and experimental protocol to compare a haptic interface vs a keyboard interface and joystick interface for legged robot-locomotion. Conducted user-studies and statistically interpreted results. Resulted in research paper accepted at IEEE IRC, 2020 and follow-up journal paper (with user-study statistics) accepted at MDPI Applied Sciences Journal. [Pub. 3 & Pub.1 respectively]
- *Joint-limit haptic feedback:* Implemented point cloud generation/retrieval models for providing haptic feedback in teleoperated robots. Resulted in research paper and presentation at IEEE ICARM, 2019.

PUBLICATIONS

[1] K.Huang, **R. Mitra**, I. Yung, D. Chitrakar,"Telelocomotion - Remotely Operated Legged Robots", MDPI Applied Sciences, 2021.

[2] **R. Mitra**, K. Boyd, D. Subedi, D. Chitrakar, E. Aldrich, A. Swamy, K. Huang,"Contact Sensing via Active Oscillatory Actuation", IEEE International Conference on Mechatronics, Robotics and Automation (ICMRA), Shanghai, China, 2020.

[3] K. Huang, D. Chitrakar, **R. Mitra**, D. Subedi, and Y.H. Su,"Characterizing Limits of Vision-Based Force Feedback in Simulated Surgical Tool-Tissue Interaction", Annual International Conference of the IEEE Engineering in Medicine and Biology Society (EMBC), Montreal, Canada, 2020.

[4] D.Chitrakar, **R. Mitra**, and K.Huang,"Haptic Interface for Hexapod Gait Execution", IEEE International Conference on Robotic Computing (IRC), Taichung, Taiwan, 2020.

[5] K.Huang, Y.H. Su, M. Khalil, D. Melesse, and **R. Mitra**,"Sampling of 3DOF Robot Manipulator Joint-Limits for Haptic Feedback," 2019 IEEE International Conference on Advanced Robotics and Mechatronics (ICARM), Osaka, Japan, 2019.

RESEARCH PRESENTATIONS

Boston University Graphics Seminar x 2
- External paper presentation: Monte-Carlo Geometry Processing, published at SIGGRAPH 2020 (Jun 2022).
- Presented our ongoing research in computational knitting (Nov 2021).

IEEE International Conference on Advanced Robotics & Mechatronics (ICARM, 2019) — July 2019
- Presented our paper on joint-limit haptic feedback. [Pub. 5]

TEACHING

Teaching Assistant x 5, Trinity College CS, Engineering Dept. — Jan 2019 - May 2021
- Data Structures & Algorithms (Head TA, Spring '21), Intro. Mechanics (Fall '20), Data Structures & Algorithms (Spring '20), Intro. Computing (Spring '19), Intro. Engineering Design (Spring '19).

PROJECTS

Machine Learning Algorithms: Implemented the perceptron algorithm, gradient descent (stochastic, adaptive & adaptive momentum - ADAMM), a neural network, minimax algorithm (for a 2-player game) from scratch. [code available on request]

Robotics: (1) Implemented Wi-Fi localization model for robotic swarms using the Raspberry Pi microcomputer and the Free Space Path Loss (FSPL) formula. (2) Worked with a team of 5 undergrads to build an autonomous navigation wheeled robot.

SKILLS

Programming: C++, Python, C, Mathematica, Matlab, HTML, CSS, Javascript, SQL, SML
Sofware & Technologies: Git, Blender, MeshLab, Gurobi, libigl, RaspberryPi