Rahul Mitra

rahulm@bu.edu
rahulmitra.xyz
Rahul Mitra
rahul-mitra13
rahul-mitra13
Boston, USA

Education

Boston University *Sept 2021 - present*
Ph.D., Computer Science
Advisor: Edward Chien
Research Focus: Computer Graphics, Geometry Processing, Digital Fabrication

Trinity College, CT *Sept 2017 - May 2021*
B.Sc. Physics (honors), B.Sc. Computer Science (honors) *GPA: 3.95/4.00*
Summa Cum Laude, Phi Beta Kappa, Sigma Pi Sigma (Physics honor society) inductee
Advisor: Kevin Huang
Research Focus: Telerobotics, Haptic User Interfaces, Contact Sensing

Technical skills

Programming	C++/C, Python, Java, Mathematica, MATLAB, OpenGL Shading Language (GLSL)
Software/Libraries	OpenGL (graphics programming), Blender/MeshLab (3D modelling), Gurobi (optimization), LibIGL, geometry-central, polyscope (geometric algorithms/3D visualization), Git

Work Experience

Game Development and Research Intern, Lightspeed Studios *May 2024 - present*
Tencent Americas *Los Angeles, USA*

- *Quad meshing for rendering/knitting*: Implemented a pipeline that uses custom striping algorithms to generate quad elements over dress patterns drawn from the GarmentCode dataset with the goal of developing novel meshing techniques for rendering and knitting of yarn level models.

Graduate Researcher, Computer Graphics Lab *Sept 2021 - present*
Boston University *Boston, USA*

- Conducting research in geometry processing techniques for tasks in digital fabrication, vector field design and meshing.
- *Stripe Patterns for Computational Knitting:* Designed and implemented a striping algorithm for generating machine-knittable graphs over input models. Our approach introduces several key techniques that allows for user-design choices while ensuring machine-knittability. See Pub. [2].
- *Foliations for Computational Knitting:* Enhanced the method of Pub. [2] by abstracting stripe patterns as foliations (integral curve lines) of a vector field. Allows for more robust graph generation, thereby further expanding the user-design space and diversity of input models. See Pub. [1].

Real-time Object Detection Aid for the Visually Impaired *Sept 2020 - May 2021*
Computer Science Senior Thesis, Trinity College *Hartford, USA*

- Implemented a system to provide real-time audio feedback on a white cane using NVIDIA's Jetson Nano microcomputer. Integrated the Raspberry Pi V2 Camera with the Nano for real-time video input. Used the ssd-inception-v2 model and tensorflow for image classification.
- Developed application for audio feedback and seamless bluetooth interfacing between user and Nano.
- Winner of best thesis award based on completeness, technical maturity and relevance.

Researcher, Perceptual Robotics & Automation Lab *Sept 2018 - May 2021*
Trinity College *Hartford, USA*

- *Vibration-based sensor*: Modelled contact-sensing as vibration-classification problem. Classified data using Guassian mixture model clustering and logistic regression. Built system to interface sensor with Raspberry Pi microcomputer (used for data collection). Pub. [4].
- *Vision-based force-feedback in Robot-Assited surgery*: Examined deviation of haptic feedback from ground truth for acceptable performance in Robot-Assisted Surgery. Explored models for node-to-node interaction in simulated tissue surface. Pub. [5].
- *Haptic Interface for Robot Locomotion*: Developed software and experimental protocol to compare a haptic interface vs keyboard and joystick interface for legged robot-locomotion. Conducted user-studies and statistically interpreted results. Pub. [3] & Pub. [6].
- *Joint-limit haptic feedback*: Implemented point cloud generation/retrieval models for providing haptic feedback in teleoperated robots. Presented paper at ICARM. Pub. [7].

Publications (chronological)

[1] **Mitra, Rahul**, Megan Hoffmann, Erick Jimenez Berumen, and Edward Chien. "Singular Foliations for Knit Graph Design" In ACM SIGGRAPH 2024 Conference Proceedings, pp. 1-11. 2024.

[2] **Mitra, Rahul**, Liane Makatura, Emily Whiting, and Edward Chien. "Helix-Free Stripes for Knit Graph Design." In ACM SIGGRAPH 2023 Conference Proceedings, pp. 1-9. 2023.

[3] Huang, Kevin, Divas Subedi, **Rahul Mitra**, Isabella Yung, Kirkland Boyd, Edwin Aldrich, and Digesh Chitrakar. "Telelocomotion—remotely operated legged robots." Applied Sciences 11, no. 1 (2020): 194.

[4] **Mitra, Rahul**, Kirkland Boyd, Divas Subedi, Digesh Chitrakar, Edwin Aldrich, Ananya Swamy, and Kevin Huang. "Contact sensing via active oscillatory actuation." In 2020 3rd International Conference on Mechatronics, Robotics and Automation (ICMRA), pp. 99-104. IEEE, 2020.

[5] Huang, Kevin, Digesh Chitrakar, **Rahul Mitra**, Divas Subedi, and Yun-Hsuan Su. "Characterizing limits of vision-based force feedback in simulated surgical tool-tissue interaction." In 2020 42nd Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC), pp. 4903-4908. IEEE, 2020.

[6] Chitrakar, Digesh, **Rahul Mitra**, and Kevin Huang. "Haptic interface for hexapod gait execution." In 2020 Fourth IEEE International Conference on Robotic Computing (IRC), pp. 414-415. IEEE, 2020. *(short paper)*

[7] Huang, Kevin, Yun-Hsuan Su, Mahmoud Khalil, Daniel Melesse, and **Rahul Mitra**. "Sampling of 3dof robot manipulator joint-limits for haptic feedback." In 2019 IEEE 4th International Conference on Advanced Robotics and Mechatronics (ICARM), pp. 690-696. IEEE, 2019.

Teaching & Mentoring

Teaching Assistant, Geometric Algorithms	Fall '24, BU.
Mentor, Summer Geometry Initiative (SGI)	Program to introduce geometry processing research to students globally. Summer '23, MIT.
Teaching Assistant, Geometry Processing (Graduate Course) $\times$ **2**	Spring '23, Spring '24, BU.
Teaching Assistant, Data Structures & Algorithms $\times$ **2**	Spring '20, Spring '21, TC.
Teaching Assistant, Classical Mechanics	Fall '20, TC.
Teaching Assistant, Introduction to Computing	Spring '19, TC.
Teaching Assistant, Mobile Robotics	Spring '19, TC.
Robotics mentor, Tech Savvy	American Association of University Women (AAUW) program introducing careers in STEM to middle school girls. Spring '18, '19.
Volunteer Teacher, Hartford Teach the Teachers	Introductory robotics program for Hartford middle schools.

Talks/Presentations

Singular Foliations for Knit Graph Design (Poster)	SGP	*2024*
Helix-Free Stripes for Knit Graph Design	SIGGRAPH	*2023*
Stripe Patterns for Computational Knitting	BU Graphics Seminar	*2022*
Sampling of 3DOF Robot Manipulator Joint-limits for Haptic Feedback	IEEE ICARM	*2019*

Awards

Eurographics Widening Participation Scholarship	Eurographics.	*2024*
President's Fellow in Physics, Class of 2021	Awared to the strongest major in the graduating class. Trinity College.	*2021*
Best Computer Science Senior Thesis	Trinity College.	*2021*
President's Fellow in Physics, Class of 2021	Awared to the strongest major in the graduating class. Trinity College.	*2021*
Albert J. Howard Jr. Prize in Physics	Awarded to the strongest major in the junior class. Trintiy College.	*2020*
Phi Gamma Delta Prize in Mathematics	Awarded for outstanding performance in mathematics coursework. Trinity College.	*2020*
Faculty Honors	Trinity College.	*All Semesters*
Full Tuition Scholarship	Trintiy College.	*2017*