SREEJANI CHATTERJEE

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I am a Ph.D. candidate in robotics engineering (graduating summer 2025) at Worcester Polytechnic Institute, advised by Dr. Berk Calli. My research focuses on leveraging and designing deep learning models to develop vision-based control and motion planning algorithms for autonomous robotic systems, eliminating dependencies on external markers and reducing reliance on prior knowledge of explicit robot models, camera parameters, or onboard proprioceptive sensors like encoders. I work at the intersection of deep learning, robotics, and computer vision, designing frameworks for perception-driven motion control and implementing real-time software pipelines using Python, C++, and ROS. My research experiments have involved working with real robotic platforms such as the Franka Emika Panda arm and the Soft Origami Arm, while my teaching experience includes hands-on work with the Robotis OpenManipulatorX and TurtleBot. Throughout my Ph.D., I have mentored graduate and undergraduate students and published papers with them in leading robotics conferences. I seek opportunities to contribute to broader challenges in autonomous systems while gaining experience in mentorship.

EDUCATION

Worcester Polytechnic Institute, Worcester, MA *January 2021 – August 2025*

- Ph.D. in Robotics Engineering
- Thesis: Markerless and model-free vision-based robotic control
- Advisor: Dr. Berk Calli
- Thesis committee: Dr. Nitin J. Sanket, Dr. Constantinos Chamzas, Dr. Chun Kit Ngan

Maulana Abul Kalam Azad University, Kolkata, India *August 2005 – May 2009*

- B.Tech in Computer Science and Engineering
- GPA: 7.98/10.0

PROFESSIONAL EXPERIENCE

Program Manager: Cisco Systems Inc, Mumbai, India
May 2019 – December 2020

Business System Analyst and Program Manager: Cisco Systems Inc, Research Triangle Park, USA
May 2015 – May 2019

Business Systems Analyst: Tata Consultancy Services Inc at Cisco Systems Inc, Mumbai, India
January 2013 – May 2015

Team Lead: Tata Consultancy Services Inc at Cisco Systems Inc, Mumbai, India
September 2010 – December 2012

Test Automation Engineer: Tata Consultancy Services Inc at Cisco Systems Inc, Mumbai, India
January 2010 – December 2012

RESEARCH EXPERIENCE

Research Assistant: Manipulation & Environmental Robotics Laboratory, WPI *January 2021 – Present*

- ***Automated Data Collection for Vision-based Keypoint Annotation:*** Developed a data collection pipeline to automatically generate labeled keypoints as visual features on a robot's body by leveraging an inpainting deep learning model to remove fiducial markers while preserving marker centers as ground-truth keypoints. The **pipeline has been open-sourced** and is publicly available at https://github.com/JaniC-WPI/KPDataGenerator

- ***Deep Learning Based Keypoint Detection:*** Modified and fine-tuned a deep learning-based keypoint detection model using the collected dataset, achieving robust, real-time markerless keypoint detection for robotic perception and control.
- ***Adaptive Visual Servoing for Model-Free Control***: Designed an adaptive visual servoing framework that leverages detected keypoints to estimate the Jacobian matrix online via a window-based least squares optimization approach, facilitating control without reliance on explicit robot models or proprioceptive sensors like encoders.
- ***Vision-only Motion Planning:*** Introduced a novel framework for collision-free motion planning of robotic manipulators that relies solely on visual features, eliminating the need for explicit robot models or encoder feedback. By leveraging the detected keypoints as natural visual features in image space, we developed and evaluated a roadmap-based strategy using a novel learning based distance metric that approximates joint displacements between keypoints along the robot's configuration, enabling effective path planning and adaptive control with improved motion feasibility and robustness.
- ***Attention-based Inpainting for Occlusion Handling:*** In the process of applying an inpainting method based on attention Unet model, to handle occlusion by reconstructing the occluded parts on the robot's body. Keypoints are inferred on the reconstructed image in real-time.
- ***Graph Neural Networks for Occlusion Handling:*** In the process of investigating the use of Graph Neural Networks (GCN, SAGEConv) to model keypoint relationships and infer occluded visual features, enhancing robustness in real-time robotic control. This approach is particularly aimed at handling complex robotic configurations, especially those involving out-of-plane motion.
- ***Software and Systems Development for Robotics:*** Designed and implemented a ROS-based software pipeline in Python and C++, streamlining real-time data collection, keypoint processing, and adaptive control execution.
- ***Leadership & organization:*** Led lab meetings, designed instructional guides for lab equipment and procedures, maintain lab git repository.

TEACHING EXPERIENCE

Research Supervisor: *August 2022 - December 2024*

- Supervised 4 **M.S. in robotics students** in directed research experience leading to **one IROS 2023** publication and **three research papers in progress** intended to be submitted as journal articles.
- Supervised 1 **undergraduate student** resulting in **a paper published in ICRA 2024**.

Laboratory Assistant: *June 2022 - May 2024*

- **Undergraduate Courses: RBE 3001, RBE 3002 – WPI Robotics Engineering**
  - Designed and authored course documents for laboratory sessions, including experiment protocols, setup instructions, and assessment guidelines to enhance student learning.
  - Maintained and managed hardware, including **Robotis OpenManipulatorX** for RBE 3001 and **TurtleBot** for RBE 3002.
  - Created user guides and technical documentation for **OpenManipulatorX** and **TurtleBot** to assist students and other laboratory staff.
- **Undergraduate Courses: RBE 1001, RBE 2002 – WPI Robotics Engineering**
  - Assisted in building and setting up project environments for student assignments and laboratory exercises.

- **Graduate Courses: RBE 500, RBE 501 – WPI Robotics Engineering**
  - Set up and maintained hardware for laboratory sessions, for the **OpenManipulatorX**.
  - Developed technical documentation and user guides for **OpenManipulatorX** to support graduate-level coursework.

Teaching Assistant *January – May 2022*
RBE 1001 - Introduction to Robotics, WPI Robotics Engineering

- Assisted students with coursework, graded assignments, and evaluated lab reports.
- Supervised and facilitated lab sessions, ensuring students' hands-on learning and troubleshooting technical issues.
- Contributed to the development of homework assignments and lab exercises to enhance student understanding of robotics concepts.

PUBLICATIONS

Journal Articles

Submitted

1. **S. Chatterjee**, A. Gandhi, B. Calli, and C. Chamzas, "Image-Based Roadmaps for Vision-only Planning and Control of Robotic Manipulators," Submitted to IEEE Robotics and Automation Letters, 2025.

In Preparation

2. **S. Chatterjee**, N. Koshta, and B. Calli, "Graph network-based occlusion handling for robust keypoint detection in vision-based robot control," in progress, 2025.
3. **S. Chatterjee**, D. Nagle, and B. Calli, "Vision based control of rigid and soft robots in out-of-plane motion," in progress, 2025.
4. V. Mullur, **S. Chatterjee**, and B. Calli, "Utilizing inpainting to handle occlusion in vision-based robot control," in progress, 2025.

Conference Proceedings

5. **S. Chatterjee**, D. Doan, and B. Calli, "Utilizing inpainting for training keypoint detection algorithms towards markerless visual servoing," in IEEE International Conference on Robotics and Automation (ICRA), Yokohama, Japan, 2024.
6. **S. Chatterjee**, A. Karade, A. Gandhi, and B. Calli, "Keypoints-based adaptive visual servoing for control of robotic manipulators in configuration space," in IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Detroit, USA, 2023.
7. A. Gandhi, **S. Chatterjee**, and B. Calli, "Skeleton-based adaptive visual servoing for control of robotic manipulators in configuration space," in IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS), Kyoto, Japan, 2022.

PRESENTATIONS

Oral Presentations

OP4. Dissertation proposal presentation, WPI *January 2025*
Title: "Markerless and model-free vision based robotic control "

OP3. International Conference on Robotics and Automation (ICRA), Yokohama, Japan *May 2024*
Title: "Utilizing inpainting for training keypoint detection algorithms towards markerless visual servoing"

OP2. International Conference on Intelligent Robots and Systems (IROS), Detroit, USA *October 2023*
Title: "Keypoints-based adaptive visual servoing for control of robotic manipulators in configuration space"

OP1. Robotics Research in Progress, WPI IEEE-RAS Chapter, Worcester, USA *July 2023*
Title: "Keypoints-based adaptive visual servoing for control of robotic manipulators in configuration space"

Poster Presentations

PP2. International Conference on Robotics and Automation (ICRA), Yokohama, Japan *May 2024*
Title: "Utilizing inpainting for training keypoint detection algorithms towards markerless visual servoing"

PP1. International Conference on Intelligent Robots and Systems (IROS), Detroit, USA *October 2023*
Title: "Keypoints-based adaptive visual servoing for control of robotic manipulators in configuration space"

AWARDS

A3. IEEE ICRA 2024 Travel Award, IEEE RAS ($2500) *March 2024*
A2. IEEE IROS 2023 Travel Award, IEEE RAS ($600) *September 2023*
A1. Dr. Glenn Yee Travel Award, Robotics Engineering Department, WPI ($750) *August 2023*

SERVICE & OUTREACH

Reviewer: ICRA, IROS, RA-L *2023 – Present*
Lead Organizer: Robotics Workshop for women in STEM conference *March 2024*
Assistant Organizer: Robotics Workshop for women in STEM conference *October 2023*
Community Presenter: TouchTomorrow, WPI (engaging youth in STEM) *July 2022*
Officer: WPI IEEE Robotics & Automation Society Chapter *2024 – Present*

SKILLS

Robotics: Deep learning, machine learning, computer vision, kinematics, control, system modeling, dynamics, manipulation
Control: Adaptive control, visual servoing
Programming: Python, MATLAB, C++, ROS, Bash, PyTorch, OpenCV, NumPy, Eigen
Platforms: Franka Emika Panda, RealSense, Robotis OpenManipulatorX, UR10, Robotis TurtleBot, Dynamixel, Origami Arm.