Shivani Kamtikar

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Ph.D. Candidate, Computer Science · University of Illinois Urbana-Champaign

RESEARCH SUMMARY

I work on learning-based manipulation of soft and hybrid robotic arms, focusing on dexterous control in cluttered and unstructured environments. My work spans diffusion-based motion planning, contact driven planning using VLAs and VLMs, tactile sensing, 3D vision-guided control, and sim-to-real transfer. My work demonstrates impact across soft and hybrid robots, anthropomorphic hands, confined-space manipulation, manufacturing, and agricultural robotics, with publications at RA-L, ICRA, and RoboSoft.

EDUCATION

University of Illinois at Urbana-Champaign   May 2022 – Dec 2026 (expected)
Ph.D. in Computer Science · Advisor: Prof. Girish Chowdhary
Relevant Courses: Robot Learning, 3D Vision, Transfer Learning, Meta Learning

University of Illinois at Urbana-Champaign   May 2022
M.S. in Computer Science · Advisor: Prof. Girish Chowdhary
Relevant Courses: Machine Learning, Computer Vision, Learning-Based Robotics, Autonomous Systems

Savitribai Phule Pune University   August 2020
B.Tech. in Information Technology

PUBLICATIONS

Conference / Journal
- **S. K. Kamtikar**, P. Asthana, N. K. Uppalapati, G. Krishnan, G. Chowdhary. "THREAD: Trajectory Planning for Hybrid Rigid-Soft Manipulators with Environment-Aware Diffusion." Under review.
- **S. K. Kamtikar**, C. H. Kim, J. Migdal, C. Tabasso, T. Brady, T. Padir. "TACTFUL: Tactile-Driven Exploration for Object Localization and Identification in Confined Environments." Under review.
- **S. K. Kamtikar**, K. Koe, J. Wasserman, S. Marri, B. T. Walt, N. K. Uppalapati, G. Krishnan, G. Chowdhary. "HyReach: Vision-Guided Hybrid Manipulator Reaching in Unseen Cluttered Environments." Soft Robotics Journal, 2026.
- C. H. Kim, **S. K. Kamtikar**, T. Brady, T. Padir, J. Migdal. "Grasp, Slide, Roll: Comparative Analysis of Contact Modes for Tactile-Based Shape Reconstruction." ICRA, 2026.
- K. Koe, S. Marri, B. Walt, **S. K. Kamtikar**, N. K. Uppalapati, G. Krishnan, G. Chowdhary. "Learning-Based Position and Orientation Control of a Hybrid Rigid-Soft Arm Manipulator." ASME Journal of Mechanisms and Robotics, 2025.
- K. Koe, P. K. Shah, B. Walt, J. Westphal, S. Marri, **S. K. Kamtikar**, J. S. Nam, N. K. Uppalapati, G. Krishnan, G. Chowdhary, "Precision Harvesting in Cluttered Environments: Integrating End Effector Design with Dual Camera Perception." ICRA, 2025.
- **S. K. Kamtikar**, S. Marri, B. T. Walt, N. K. Uppalapati, G. Krishnan, G. Chowdhary. "Visual Servoing for Pose Control of Soft Continuum Arm in a Structured Environment." IEEE Robotics and Automation Letters (RA-L) + RoboSoft 2022. [Oral Presentation]

Workshop Papers
- **S. K. Kamtikar** et al. "Visual Servoing for Pose Control of Hybrid Continuum Manipulator in an Unstructured Environment." CoRL 2023 Workshop on Learning for Soft Robots.
- **S. K. Kamtikar** et al. "Realistic Simulation Environments to Achieve Visual Servoing on Soft Continuum Arms in Constrained Environments." MLCAS 2022.
- **S. K. Kamtikar** et al. "Towards Autonomous Berry Harvesting using Visual Servoing of Soft Continuum Arm." AIAFS Workshop 2022.

WORK EXPERIENCE

Applied Scientist II Co-op - Amazon Robotics   Jan 2025 – Jul 2025
Mentor: Dr. Taskin Padir and Dr. Josh Migdal
- Developed a vision-free autonomous tactile exploration framework enabling anthropomorphic hands (Inspire Dexterous FTP) to localize and identify objects in confined environments (paper under review)
- Designed a learned policy combining behavior cloning and reinforcement learning (RL) using tactile point clouds for 3D object reconstruction
- Introduced a dynamic reward schedule balancing global exploration and local interaction; achieved lower Chamfer distances and higher success rates vs. baselines
- Advanced tactile sensing as a primary perception modality for robotic manipulation in unstructured settings
- Conducted a study on how different contact modes affect object shape reconstruction using a tactile-enabled dexterous gripper (accepted at ICRA 2026)

RESEARCH EXPERIENCE

Diffusion-Based Path Planning for Hybrid Continuum Manipulators
- Designed the first ever diffusion-based generative planner for feasible backbone trajectories of hybrid soft-rigid manipulators, conditioned on scene geometry and goal constraints (paper under review)
- Developed a unified shape-aware motion planning framework producing low-strain, collision-free trajectories in confined spaces
- Implemented inference-time collision avoidance with online reinforcement learning (RL) refinement
- Demonstrated sample-efficient cross-embodied real-world transfer in hybrid robots

Contact-Driven Planning via Vision-Language Models (VLMs)
- Developed a VLM-guided, contact-aware planning framework for hybrid manipulators, enabling intentional bracing and wrapping around obstacles
- Designed a diffusion-based motion generator conditioned on VLM-predicted contact affordances for confined-space manipulation
- Demonstrated extended workspace reach, reduced actuator strain, and improved stability near obstacles

3D Vision-Guided Autonomous Manipulation of Hybrid Robots
- Developed a real-time open-world reaching system for rigid-soft continuum manipulators in unstructured environments (paper under review)
- Enabled obstacle avoidance through 3D reconstruction and shape-informed path planning without expensive sensors
- Achieved 98% pose accuracy with a novel learned controller for the hybrid arm system

Learning-Based Control of Soft Robotic Arms
- Built a deep neural network for robust 3D positioning of soft robotic arms using visual feedback from a distal-end camera (accepted at RA-L & RoboSoft)
- Achieved state-of-the-art performance: translation error < 2 cm and rotation error < 0.25 rad
- Demonstrated transferability to new environments with minimal retraining, enabling scalable deployment

TECHNICAL SKILLS

Research Areas: Robotics (Tactile Sensing, RL, Imitation Learning, Visual Servoing, Soft Robotics, Manipulation), 3D Computer Vision (SLAM, 3D Reconstruction, RGB-D Fusion), Generative Models (Diffusion Models, VLMs, Transformers) for Robot Planning
Programming & Tools: Python, PyTorch, ROS, ROS2

AWARDS & RECOGNITION

- Future Leaders of Robotics and AI Award - University of Maryland, College Park, 2025
- Student Leadership Award (GIANT Award) - IDEA Institute, UIUC, 2025

- IBM Research Grant ($11,000 USD) - Undergraduate final-year project, 2021
- Best Outgoing Student Award - Savitribai Phule Pune University
- Patent granted by the Indian Patent Office for Indian Sign Language Recognition system

INVITED TALKS

- Future Leaders of Robotics and AI Seminar Series - University of Maryland, College Park, 2025
- MLCAS Fourth International Workshop on ML for Cyber-Agricultural Systems - 2022
- AI for Agriculture and Food Systems (AIAFS) Workshop - 2022

SERVICE & LEADERSHIP

Teaching Assistant
- CS 102: Little Bits to Big Ideas — UIUC (Jan 2026 – May 2026)
- CS 498: Introduction to Deep Learning — UIUC, with Prof. Lana Lazebnik (Sep–Dec 2020)

Reviewing:
- IEEE Robotics and Automation Letters (RA-L)
- IEEE International Conference on Robotics and Automation (ICRA)
- IEEE India Council International Conference (INDICON) 2024

Community:
- GradSWE Director, UIUC — 2025–2026
- weSTEM 2025 Director, UIUC
- Computer Science Representative, Engineering Graduate Student Advisory Council (EGSAC) — 2023–2024
- General Chair, CSL Student Conference 2024
- Robotics Chair, CSL Student Conference 2023