Vaibhav Sanjay

✉ vsanjay@andrew.cmu.edu GitHub Google Scholar https://vaibhavsanjay.github.io

EDUCATION

Carnegie Mellon University (GPA 4.0) **Aug 2025 – May 2027 (Expected)**

Degree: M.S. in Robotics (MSR), **Advisor:** Dr. Jiaoyang Li

Selected Coursework*: Multi-Robot Planning & Coordination, Advanced Computer Vision, Intro to Robot Learning*

University of Maryland, College Park (GPA 3.98/4.00**)** *Summa Cum Laude* **Aug 2021 – May 2025**

Majors: Computer Science & Mathematics; ***Minor****:* Robotics and Autonomous Systems

PUBLICATIONS AND REPORTS

[1] **Diffusion for Long-Horizon Multi-Robot Path Planning in Human-Shared Environments**
Vaibhav Sanjay, Yorai Shaoul, Jiaoyang Li
IEEE/RSJ Intl. Conference on Intelligent Robots and Systems (IROS), 2026
Best Paper Award - 5th Workshop on Social Robot Navigation*, IROS 2026*

[2] **Scalable Long-Horizon Planning with Staggered Updates for Lifelong MAPF**
Vaibhav Sanjay, Jiaoyang Li
(Under Review)

[3] **RoboFin3D: A Sim-to-Real Platform for Robotic Surface Finishing**
Haowei Wen, Shangtao Li, **Vaibhav Sanjay**, Philip Huang, Jiaoyang Li, Changliu Liu
IROS 2026 Workshop on Sim2Real and Classical Control, 2026

[4] **Illusion3D: 3D Multiview Illusion with 2D Diffusion Priors**
Yue Feng, **Vaibhav Sanjay**, Spencer Lutz, Songwei Ge, Badour AlBahar, Jia-Bin Huang
SIGGRAPH Asia Technical Communications, 2026

[5] **Image Stitching with Real-Time Panorama Creation for the NIOSH Mine Rover (Technical Report)**
Vaibhav Sanjay, Erica Tevere, Xavier Zapien
NASA Jet Propulsion Laboratory, 2023

[6] **Where Am I Now? Dynamically Finding Optimal Sensor States to Minimize Localization Uncertainty for a Perception-Denied Rover**
Troi Williams, Po-Lun Chen*, Sparsh Bhogavilli*, **Vaibhav Sanjay***, Pratap Tokekar
IEEE International Symposium on Multi-Robot and Multi-Agent Systems (MRS), 2023

RESEARCH EXPERIENCE

Artificial Intelligence for Robot Coordination at Scale Lab (CMU RI) **Aug 2025 - Present**

- Working with Dr. Jiaoyang Li on scalable multi-robot coordination across learned and classical planners.
- Developed **Multi-Robot Rolling Diffusion (MRRD)**, a diffusion model planner capable of simultaneously generating predictable, humanlike paths in a human-shared environment. Maintains 92% success rate (nearly 3 times the best baseline) while planning with **15 robots in a crowded environment**.
- Created **Path Updates over Staggered Horizons (PUSH)**, a lifelong MAPF planner achieving sub-second coordination of **up to 10,000 agents** with formal deadlock-avoidance guarantees. On simulated warehouse loading/unloading benchmarks, PUSH raises throughput by up to 300% over scalable baselines including PIBT and EPIBT. Under review.

Graduate RA with Advanced Robotics for Manufacturing Institute (CMU RI) **Jan 2026 - Present**

- Collaborating with the ARM Institute, Professor Changliu Liu, and Professor Jiaoyang Li on RoboFin3D, an automated robotic grinding, welding and sanding system.
- Developing a **two-arm planner** that couples workpiece reorientation with weld sequencing, covering all seams in the fewest rotations.
- Multi-arm planner reports a **95% average weld reachability** on a comprehensive workpiece dataset.
- Presented demo of prototype at IROS 2026 during technical tour of CMU Robotics Innovation Center.

* Equal contribution

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UMD Vision and Learning Lab **Dec 2023 - Aug 2025**

- Worked with Dr. Jia-Bin Huang to simulate three-dimensional illusions using **Diffusion** models.
- Developed **differentiable rendering** methods for curved, rotating, and reflective surfaces.
- Trained a **Neural Radiance Field** to hide images in a 3D model, producing multi-view 3D illusions.

NASA Jet Propulsion Laboratory [Group 347F] **Jun 2023 - Aug 2023**

- Engineered and deployed an **OpenCV/CUDA** panoramic vision system with Dr. Rudranarayan Mukherjee and Erica Tevere for a teleoperated rescue rover, enabling **real-time** operation and superior control.
- Ensured a strict frame rate budget using a registration and compositing pipeline, improving end-to-end latency to 0.06 seconds (**65% improvement**) and producing a frame rate of 18 Hz (**237% improvement**).

UMD Robotics Algorithms and Autonomous Systems (RAAS) Lab **Jan 2022 - Jun 2023**

- Worked with Dr. Pratap Tokekar and Dr. Troi Williams to use drone and robotic **perception** to track and guide sensor-less rovers around obstacles. Tested implementation using **Vicon** motion capturing system.

National Institute of Standards and Technology (NIST) **Jun 2022 - Aug 2022**

- Worked with Dr. Jacob Collard and a startup to create an encyclopedia of math concepts using **NLP**.
- Graphed 4000 terms and 6000 relations with Python and neo4j to create knowledge graphs.

TEACHING AND MENTORING

Teaching Assistant for Multi-Robot Planning and Coordination (16-891) **Aug 2026 - Present**

- Chosen by Dr. Jiaoyang Li as sole TA to **graduate-level course** on MAPF and multi-robot coordination.
- Assisting design of assignment structure; **evaluating over 30 graduate student project pitches** and presentations for state-of-the-art MAPF contributions in final projects.

Paths to AI Research (PAIR) Mentor **Sep 2025 - May 2026**

- Mentored two freshmen in AI research by helping them narrow their interests, join labs, and contribute to group work that led to co-authorship in a top-tier conference submission.

TALKS

[1] **Diffusion for Long-Horizon Multi-Robot Path Planning in Human-Shared Environments**
IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)
Pittsburgh, PA, Sept 2026. [Oral Presentation and Poster]

[2] **Illusion3D: Generating 3D Illusions using Diffusion Models**
UMD Undergraduate Research Day (URD), College Park, MD, 2024, [Poster]

[3] **Image Stitching with Real-Time Panorama Creation for the NIOSH Mine Rover**
NASA Jet Propulsion Laboratory, Pasadena CA, 2023. [Presentation]

[4] **Term and Relation Extraction in Mathematical Texts**
National Institute of Standards and Technology (NIST), Gaithersburg, MD, 2022. [Presentation]

PROFESSIONAL EXPERIENCE/LEADERSHIP

Software Engineering Intern at Amazon Web Services **Jun 2024 - Aug 2024**

- Developed a ReactJS AWS Marketplace feature for cloning private offers, cutting workflow time by 91%.

Google Developer Student Club (GDSC) Lead/President **Aug 2022 - Aug 2023**

- Led 450-member club, delivered workshops for 100+ people, initiated well received guest expert events.

AWARDS

Best Paper Award, 5th Workshop on Social Robot Navigation, IROS 2026
Developer Community Excellence Award, University of Maryland, College Park (2025)
President's Scholarship, University of Maryland, College Park (2021- 2025)
Summer Research Fellowship, National Institute of Standards and Technology (NIST) (2022)

TECHNICAL SKILLS

Python, C++, CUDA, PyTorch, PyTorch3D, ROS1/ROS2, Gazebo, Docker, MATLAB