PUSHYAMI KAVETI

4640 Hilltop Rd, Soquel, CA 95073

www.mbari.org/person/pushyami-kaveti/ * pkaveti@mbari.org * www.linkedin.com/in/pushhyamiikaaveeti

RESEARCH INTERESTS

My research interests include multi-camera perception, 3D reconstruction and Simultaneous Localization, and Mapping in dynamic and visually degraded environments, including urban, marine, and polar regions.

EDUCATION

Ph.D. in Computer Science (Robotics) *Sep 2016 - Aug 2022*

Northeastern University, Thesis Committee: Hanumant Singh(Advisor), John Leonard(MIT), Ryan Eustice (TRI), Chris Amato, Lawson Wong. Thesis topic: Multi-Camera Sensing for Robust Perception in Robotics

M.S. in Computer Engineering *Aug 2012 - May 2014*

University of Florida, Gainesville

B.Tech., Computer Science and Engineering *Sep 2007 - May 2011*

Jawaharlal Nehru Technological University, Anantapur, India.

RESEARCH AND WORK EXPERIENCE

Monterey Bay Aquarium Research Institute (MBARI) Moss Landing, CA

Postdoctoral Fellow *Jun 2025 - Present*

- Multi-modal representation learning for underwater navigation and mapping via fusion of optical and acoustic sensing for AUVs and ROVs.
- Self-supervised learning to enhance object detection, scene understanding, and semantic mapping.
- Multi-modal adaptations of 3D Gaussian splatting for real-time, large-scale dense mapping.

Norwegian University of Science and Technology (NTNU) Trondheim, Norway

Visiting Researcher *Apr 2024 - Jul 2024*

- Enhancing situational awareness for autonomous and remotely operated underwater vehicles via multi-camera perception and sensor fusion for pipeline following, inspection etc.
- Real-time dense reconstruction of underwater scenes, including subsea infrastructure and shipwrecks.

Institute of Experiential Robotics, Northeastern University Boston, MA

Postdoctoral Researcher *Oct 2022 – Apr 2025*

- Toyota Research Institute Funded collaboration on Multi-modal Simultaneous Localization and Mapping, including multi-camera and inertial sensing for high-speed dynamic motions.
- Information theoretical approaches for optimal sensor arrangement on a mobile robot for accurate and robust SLAM.
- 3D mapping of dynamically calving glaciers using multi-sensor fusion of data collected from an Autonomous Surface Vehicle at Ny Alesund Arctic research station in Svalbard.

Northeastern University Field Robotics Laboratory Boston, MA

Graduate Research Assistant under Dr. Hanumant Singh *Sep 2016 – Aug 2022*

- Ph.D research focusing on achieving **robust and real-time** robot perception using multi-camera systems. Enable robot localization & mapping in real-world environments consisting of visually degraded environments, dynamic objects, and occlusions. https://youtu.be/55hwdmTZOi4.
- Design and development of hardware & software stack for synchronized capture on a multi-camera array.
- Deep Learning methods on underwater and IR imagery for object detection and image registration.
- Led the sensor selection, design, and integration effort for an audio-visual interface on the mobile robotic platform for AVATAR Xprize competition.
- **Robotic Platforms**: Experience working with **autonomous driving** platforms (Dataspeed Lincoln MKZ), **aerial vehicles** (DJI, Pixhawk, Intel Aero drone), **ground vehicles** (Warthog from Clearpath, Turtlebot)

PUSHYAMI KAVETI

4640 Hilltop Rd, Soquel, CA 95073

www.mbari.org/person/pushyami-kaveti/ * pkaveti@mbari.org * www.linkedin.com/in/pushhyamiikaaveeti

Toyota Research Institute Cambridge, MA

Research Intern, Dr. Simon Stent *June – August 2018*

- Methods for understanding driver interruptibility to design intelligent speech-based interfaces in ADAS.
- Developed a synchronized and feature-rich driver-centric dataset to explore driver-car interaction.
- Performed analysis on CAN bus data and developed a model to predict vehicle-driver communication timing that correlated with driver responses.

Florida Institute for Human and Machine Cognition (IHMC) Pensacola, FL

*Research Intern, **Darpa Robotics Challenge**, Dr. Jerry Pratt* *June – August 2014*

- Integration of **Multisense SL** sensor from Carnegie Robotics into ihmc's user interface. Validating and debugging the firmware, URDF model, and the API.
- Worked on implementation and visualization of the octree occupancy map of the world using point cloud data obtained from the **LIDAR**.
- Developed test cases for the IHMC code base to improve code coverage and reduce bugs.

*Research Intern, **Darpa Robotics Challenge trials**, Dr. Jerry Pratt* *August – December 2013*

- Developed state machine based high-level controller performing pre-defined behaviors for "**Atlas**", a humanoid manufactured by Boston Dynamics using low-level API
- Integrated Black fly fish-eye cameras, including developing drivers, ros services and dynamic reconfiguring of parameters in **ROS**, video subscribing and compression, and user interface development.
- Implemented **RANSAC** for fitting planes onto the LIDAR data to find the orientation of terrain to be used for placing the virtual footsteps in the user interface.
- Developed a producer/ consumer based software model for sending the planned footsteps over network from robot to the user interface.

Alces Technology Ltd Park city, UT

Computer Vision Engineer / Software Developer *October 2014 – May 2016*

- Registration of multi-view point clouds was obtained from the Alces **Structured Light system** using the point cloud library (PCL) to generate a full 3D mesh.
- Developed **Stereo Calibration** routine for Alces structured light system which consists of a camera and a laser projector to obtain the projection matrix and reconstruct 3D point clouds.
- Developed block addressable phase unwrapping and camera alignment technique for calibration of the Alces structured light system under the guidance of Dr. David Bloom.

PUBLICATIONS

- Wise, E., **Kaveti, P.**, Chen, Q., Wang, W., Singh, H., Kelly, J., Rosen, D.M. and Giamou, M., 2025. A certifiably correct algorithm for generalized robot-world and hand-eye calibration. *The International Journal of Robotics Research*, p.02783649261420308.

- **Kaveti, P.**, Waldum, A. G., Singh, H., & Ludvigsen, M. (2025). Enhancing Situational Awareness in Underwater Robotics with Multi-modal Spatial Perception. *arXiv preprint arXiv:2506.06476*. (ICRA workshop on field robotics 2025)

- Shah.V., **Kaveti.p**., Schild, K., Lindeman, M., Duncan, D., Sutherland, D., Cenedese, C., Straneo, F. and Singh, H. Volume Loss Estimate for Icebergs - SfM in Low Contrast, Dynamic Environments. (Under submission to Science Robotics)

- **Kaveti, P.**, et al. "Enhancing Situational Awareness in Underwater Robotics With Real-Time Multi-CameraMapping.", *https://miw2024.org/*, 5th Marine Imaging Workshop (2024).

- Preston,V., **Kaveti, P.,** Giaya, D., Gupta,A., Lubetkin, M.,, Shank T., Singh, H., Fornari, D., (2024) Considerations for Advancing Seafloor Imaging to Enable Long-term Monitoring, Journal of Ocean Technology 2024.

PUSHYAMI KAVETI

4640 Hilltop Rd, Soquel, CA 95073
www.mbari.org/person/pushyami-kaveti/ * pkaveti@mbari.org * www.linkedin.com/in/pushhyamiikaaveeti

- Keil, C., Gupta, A., **Kaveti, P.**, & Singh, H. (2024). Towards Long Term SLAM on Thermal Imagery. *arXiv preprint arXiv:2403.19885*. (accepted at IROS 2024)
- **Kaveti, P**., Giamou, M., Singh, H., & Rosen, D. M. (2023). OASIS: Optimal Arrangements for Sensing in SLAM. *arXiv preprint arXiv:2309.10698*. ICRA 2024.
- **P. Kaveti,** S. N. Vaidyanathan, A. T. Chelvan and H. Singh, "Design and Evaluation of a Generic Visual SLAM Framework for Multi-Camera Systems," in *IEEE Robotics and Automation Letters*, 2023 vol. 8, no. 11, pp.
- **P. Kaveti *et al***., "Challenges of Indoor SLAM: A Multi-Modal Multi-Floor Dataset for SLAM Evaluation," *2023 IEEE 19th International Conference on Automation Science and Engineering (CASE)*, Auckland, New Zealand, 2023, pp. 1-8, doi: 10.1109/CASE56687.2023.10260618.
- Zhang, Z., **Kaveti, P.**, Singh, H., Powell, A., Fruh, E., & Clarke, M. E. (2023). An iterative labeling method for annotating marine life imagery. *Frontiers in Marine Science*, *10*, 1094190.
- Bai, X., Luo, Y., Jiang, L., Gupta, A., **Kaveti, P**., Singh, H. and Ostadabbas, S., 2024. Bridging the Domain Gap between Synthetic and Real-World Data for Autonomous Driving. Journal on Autonomous Transportation Systems, 1(2), pp.1-15.
- Bai, X., Jiang, L., Luo, Y., Gupta, A., **Kaveti, P**., Singh, H. and Ostadabbas, S., 2023, June. An Evaluation Platform to Scope Performance of Synthetic Environments in Autonomous Ground Vehicles Simulation. In *ICASSP 2023-2023 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)* (pp. 1-5). IEEE.
- **Kaveti, P**. (2022). *Multi-Camera Sensing for Robust Perception in Robotics* (Doctoral dissertation, Northeastern University).
- Luo, R., Wang, C., Schwarm, E., Keil, C., Mendoza, E., **Kaveti, P**., Alt, S., Singh, H., Padir, T. and Whitney, J.P., 2022, October. Towards Robot Avatars: Systems and Methods for Teleinteraction at Avatar XPRIZE Semi-Finals. In *2022 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)* (pp. 7726-7733). IEEE.
- **Kaveti, P.**, Nir, J. S., & Singh, H. (2021, September). Towards Robust VSLAM in Dynamic Environments: A Light Field Approach. In *2021 IEEE International Conference on Multisensor Fusion and Integration for Intelligent Systems (MFI)* (pp. 1-8). IEEE..
- Shah, V., Nir, J., **Kaveti, P.**, & Singh, H. (2021, September). Performance Analysis of Feature Detectors and Descriptors in Underwater and Polar Environments. In *OCEANS 2021: San Diego–Porto* (pp. 1-7). IEEE.
- **Kaveti, P**., Katt, S., & Singh, H. (2020). Removing dynamic objects for static scene reconstruction using light fields. *arXiv preprint arXiv:2003.11076*.
- **Kaveti, P**., & Akbar, M. N. (2020, June). Role of intrinsic motivation in user interface design to enhance worker performance in Amazon MTurk. In *Proceedings of the 13th ACM International Conference on PErvasive Technologies Related to Assistive Environments* (pp. 1-7).
- **Kaveti, P.,** & Singh, H. (2021). ROS Rescue: fault tolerance system for Robot Operating System. Robot Operating System (ROS) The Complete Reference (Volume 5), 381-397.
- Is Now A Good Time?: An Empirical Study of Vehicle-Driver Communication Timing, R Semmens, N Martelaro, **P Kaveti**, S Stent, W Ju - Proceedings of the 2019 CHI Conference on Human Factors in Computing Systems.
- **Kaveti, P**., & Singh, H. (2018). Towards Automated Fish Detection Using Convolutional Neural Networks. 2018 OCEANS - MTS/IEEE Kobe Techno-Oceans (OTO), 1-6.

PUSHYAMI KAVETI

4640 Hilltop Rd, Soquel, CA 95073

www.mbari.org/person/pushyami-kaveti/ * pkaveti@mbari.org * www.linkedin.com/in/pushhyamiikaaveeti

• Johnson, Matthew, et al. "Team IHMC's Lessons Learned from the DARPA Robotics Challenge Trials." Journal of Field Robotics 32.2 (2015): 192-208.

PRESENTATIONS

- Invited talk at Autonomous Investigation During Ocean Drilling (AID) workshop, "3D vision for underwater robot perception in the context of AUV Operations", January 15 - 17, 2025.
- WHOI invited talk at the AOPE seminar series, "Robust Perception for Field Robotics in Extreme unstructured Environments", Oct 2024
- NU-WHOI Joint Research Symposium," Marine and Polar Robotics - Platforms, Sensors and Algorithms.", June 2022.
- MIT Invited talk at Robust Robotics Group, "Towards Robust Perception in Robotics," Nov 2022.
- New England Robotics Colloquium. Pushyami Kaveti, Skanda Akkihebbal Prasanna, Hanumant Singh, High-resolution 3D mapping of sea-terminating glaciers using autonomous surface vehicle, Nov 2023.
- NU-NTNU Joint Seminar, "Multi-camera sensing for SLAM", March 2022.

OPENSOURCE CONTRIBUTIONS

Code:

- ROS driver for FLIR cameras integrating Spinnaker SDK, including hardware synchronization options for Ubuntu Systems. https://github.com/neufieldrobotics/spinnaker_sdk_camera_driver
- A generic Multi-camera SLAM system for arbitrary camera system configurations https://github.com/neufieldrobotics/MultiCamSLAM
- Information theoretic optimization for optimal camera arrangement for determining mount points on a mobile robot https://github.com/PushyamiKaveti/optimal_camera_placement
- Rosbag toolkit which includes read/write, conversion to/from pandas and Matlab formats, downsampling, filtering, and visualization of rosbags - https://github.com/neufieldrobotics/rosbag_toolkit

Datasets:

- NUFR-M3F - Multi-modal SLAM dataset with cameras, IMU, and lidar sensors collected across multiple floors of an urban office building, that features symmetrical floors and elevator rides highlighting challenges like perceptual aliasing and visual degradation. https://github.com/neufieldrobotics/NUFR-M3F
- Multi-camera dataset for benchmarking SLAM solutions in indoor and outdoor environments with GPS and optitrack ground truth: https://tinyurl.com/2t7xdcfz

FIELD DEPLOYMENTS AND COMPETITIONS

ROV Survey of Whale Bones
Utqiagvik, Alaska, August 2025
Conducted ROV Survey of the whale bones, which were deployed at a chosen location off the coast of Utqiagvik to conduct a controlled study of the ecological significance of the subsistence whale remains. The data collected, including imagery from a GoPro and the ROV's native camera, was used to construct and label the 3D models of the whale bones and detect changes over time.

Sea ice Survey from USCGC Healy
Chukchi Sea, Alaska, October 2024
Led the ROV survey of the underside of freshly forming pancake sea ice in the Chukchi Sea, northwest of Alaska, aboard the Icebreaker *Healy*. The collected data includes imagery from a GoPro and the ROV's native camera, along with telemetry data, which will be used to analyze the structural properties of the sea ice.

ROV Minerva Deployment at NTNU
Trondheim, Norway, June 2024

PUSHYAMI KAVETI

4640 Hilltop Rd, Soquel, CA 95073

www.mbari.org/person/pushyami-kaveti/ * pkaveti@mbari.org * www.linkedin.com/in/pushhyamiikaaveeti

Built and integrated a multi-camera rig with inertial sensing and a mini computing unit on ROV Minerva for inspecting subsea infrastructure and two wreck sites, including a shipwreck Hercules and a plane wreck off the coast in Trondheim fjord. The dataset is used to reconstruct dense maps of these targets.

High-resolution Mapping of the Glacier front
Ny Alesund, Svalbard. Sep 2023
Responsible for system and software development, ASV integration, and field operations for the Arctic expedition at Ny Alesund research station in Svalbard in collaboration with researchers from NTNU (Norway). Our system was used for multiple deployments to collect repeated data at two glaciers (Kongsbreen and Blomstranda) in an effort to map and detect changes at the front of these active calving glaciers.

Sensor Platform Design and development for Antarctic Sea-ice study
Rothera Research Station, Antarctica. Dec 2022
Designed and developed the camera units and related software for the United Kingdom's British Antarctic Survey (BAS) scientific program called Drivers and Effects of Fluctuations in Sea Ice in the Antarctic (DEFiANT). The imaging units were used to collect data from an aircraft that was used to study the variability of Antarctic sea ice due to climate change.

ANA Avatar Xprize Challenge
Aug 2021 - Nov 2022
Led the sensor selection, design, and integration effort for the audio-visual interface on the mobile robotic platform for AVATAR Xprize competition aimed at creating an avatar system that allows seamless remote interaction by a human operator in real-time.
Seabed AUV deployment with NOAA Fisheries
Monterey Bay, California, June 2017
Worked closely with scientists from NOAA while they deployed Seabed to collect underwater imagery and other sensor data for ecosystem monitoring and fisheries habitat characterization.

Darpa Robotics Challenge
Miami, Florida, Dec 2013. Pomona, California, 2015
Research intern at Florida Institute for Human and Machine Cognition developing code for sensor integration, operator user interface, and point cloud processing algorithms to enable remote and autonomous operation of Boston Dynamics' Atlas humanoid.

MEDIA

- **Northeastern Researchers Explore the Arctic With Robot to Learn How Fast Glaciers Are Melting**, *Robotics247*, 2023
- **How fast are Arctic glaciers melting? A team of Northeastern engineers explored the north with a robot and cameras to find out**, *Northeastern University News*, 2023
- **Northeastern Team Advances to Finals of ANA Avatar XPRIZE**, *Northeastern University Institute of Experiential Robotics News*, 2022
- **Creating a Human Avatar in Remote Locations,** *Northeastern University College of Engineering news*, 2021.
- **IHMC's Running Man captures 2nd at DARPA robotics competition**, Florida Institute for Human and machine Cognition, 2015.

ACTIVITIES AND SERVICE

Reviewer
- IEEE Journal of Ocean Engineering
- IEEE International Conference on Robotics and Automation (ICRA)

PUSHYAMI KAVETI

4640 Hilltop Rd, Soquel, CA 95073

www.mbari.org/person/pushyami-kaveti/ * pkaveti@mbari.org * www.linkedin.com/in/pushhyamiikaaveeti

- International Symposium of Robotic Research (ISRR)
- International Symposium on Experimental Robotics (ISER)
- IEEE International Conference on Intelligent Robots and Systems (IROS)
- IEEE Robotics and Automation Letters (RA-L)
- IEEE International Symposium on Safety, Security, and Rescue Robotics (SSRR)
- IEEE OES AUV Symposium (AUV)
- Robotics and Autonomous Systems (RAS)
- IEEE Transactions on Field Robotics (T-FR)

Teaching

- Lecturer for EECE 7150 Autonomous Field Robots *Fall 2023*
  College of Engineering at Northeastern University
  Took up complete teaching responsibility for the graduate level course in terms of designing and teaching the course, preparing syllabus, grading criteria, projects, and assignments.

- Teaching Assistant for EECE 5554 Robot Sensing and Navigation Spring *2020*
  College of Engineering at Northeastern university.
  Developed materials for the graduate-level course, mentored students during the semester with their projects, and took up teaching and grading responsibilities.

Leadership and Mentoring

- Organizer for NU-NTNU joint technical seminar series which aims to show case robotics research projects of the graduate students to foster collaborations. *Jan-April 2023*
- Mentored several master's students in the engineering and robotics program with their theses and projects at the Field Robotics Laboratory.
  Samson Braun, Sahil Ghanghas, Ayush Garg, Arvind Thamilchelvan, Avinash Ayite (Primary Advisor Dr Hanumant Singh)
  Shankara Narayanan Vaidyanathan, Aryaman Patel (Primary Advisor Dr David Rosen)

Memberships

- Marine Technology Society (MTS) student member
- IEEE student member
- IEEE Women in Engineering

Volunteering/outreach

- Marine robotics knowledge session and interaction at the Barrow Arctic Research Center (BARC) science fair for K12 students.
- Massrobotics Jumpstart Fellowship Mentor
- Active member of Women in Robotics Boston chapter - 2021 - 2025
- Graduate Women Coders at Northeastern University - 2017-2018
- Served as a committee member on graduate Indian Student Association at Northeastern University to promote inclusion and cultural diversity - 2018 -2019
- Tutor at Teton literacy center in Jackson Hole, Wyoming to help immigrant kids with English language.
- Volunteered at M.E.S.S hall (Math, Engineering, Science, and stuff) in Pensacola for kids in STEM.
- Mentored the high-school team, ***Robobroncs*** at Jackson Hole, Wyoming for the First Robotics Challenge - 2013-2014.