

Haresh Karnan

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in HareshKarnan
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Education

Ph.D. in Artificial Intelligence and Robotics

The University of Texas at Austin, TX, USA

Affiliation: [Peter Stone](#), Learning Agents Research Group

Aug 2018 – Dec 2023

Thesis: Aligning Robot Navigation Behaviors with Human Interests and Preferences

Research Areas: Reinforcement Learning, Self-Supervised Learning, Imitation Learning, Deep Learning

Relevant Courses: Machine Learning, Reinforcement Learning, Autonomous Robots, Deep Learning

M.S. in Robotics

Texas A&M University, TX, USA

Affiliation: Robert Skelton, Tensegrity Research Group

Aug 2016 – July 2018

Research Areas: Computer Vision, Robotics, State Estimation, Control

Relevant Courses: Probabilistic Robotics, Computer Vision, State Estimation, Artificial Intelligence

B.Tech. in Instrumentation and Control Engineering

National Institute of Technology, Trichy, India

Affiliation: Robotics and Machine Intelligence Club

June 2012 – July 2016

Relevant Courses: Data Structures and Algorithms, Neural Networks, Pattern Recognition

Work Experience

The University of Texas at Austin

Aug 2019 – Present

Graduate Research Assistant

Austin, TX, USA

- Designed state-of-the-art **sim-to-real** algorithms for the NAO humanoid soccer robots, enabling fast and robust walk on bumpy surfaces using **reinforcement learning**, significantly improving safety. [\[Video\]](#)
- Developed efficient **imitation learning** algorithms for learning from expert demonstrations on physical hardware, addressing egocentric viewpoint and embodiment mismatch between agents. [\[Video\]](#)
- Designed a **self-supervised representation learning** method for preference-aligned off-road navigation, enabling the Spot robot to autonomously hike a 3-mile trail successfully in Austin, Texas. [\[Video\]](#)
- Curated and published a large-scale **dataset** of demonstrations for socially-compliant robot navigation. Designed **inverse reinforcement learning** techniques to learn reward functions for navigation. [\[Dataset\]](#)
- Extended learned inverse-dynamics models with egocentric vision-based onboard sensing to improve the accuracy of **mobile robots navigating at high speeds** of 4m/s. [\[Video\]](#)
- Mentored** undergraduate students with their research, and **collaborated** with faculty and other graduate students on research topics spanning reinforcement learning, imitation learning, and generative AI.

Amazon Robotics (Amazon Scout)

May – Aug 2019/20/21

Applied Scientist Intern

Seattle, WA, USA

- Improved localization accuracy by 32% through **contrastive visual representation learning** for weather and lighting invariant visual localization. Deployed the learned model on the Scout robot, integrating it with the existing C++ stack for real-world deployment.
- Implemented **deep learning-based keypoint features**, achieving over 55% improvement in fine pose estimation accuracy in unstructured outdoor environments while maintaining a real-time inference rate.
- Developed a novel **generative adversarial algorithm** for monocular **visual localization** on sidewalks, resulting in 30% improved accuracy, compared to an existing classical visual localization pipeline. Filed and published a patent at USPTO, highlighting innovative aspects of the approach. [\[Patent\]](#) [\[News Coverage\]](#)

Texas A&M University

Aug 2016 – July 2018

Graduate Research Assistant

College Station, TX, USA

- Conducted research on various topics including (1) Vision-based tracking of tensegrity robots, (2) Simulating non-linear dynamics of tensegrity robots through physics-based first-principles modeling, (3) Optimal shape control of tensegrity robots on real hardware (master's thesis). [\[Video\]](#)

Robot Competitions

RoboCup Domestic Standard Platform League

Team: AustinVilla@Home

Summer 2019/20/21

Austin, TX, USA

- Participated in RoboCup 2019-2022 representing AustinVilla@Home in DSPL and **won third place internationally**, placing **first among North American teams** at RoboCup 2021. [\[Paper\]](#) [\[Video\]](#)
- Implemented “take out the trash” task to perform autonomous cleanup of an indoor environment by the HSR robot. [\[Video\]](#)
- Built a synthetic data generation pipeline to train object detection and segmentation networks on YCB RoboCup objects.

Teaching

Teaching Assistant

Intro to Programming and Numerical Optimization

Fall 2018, Spring 2019

Technical skills

Programming Languages

Python, C++

Libraries

PyTorch, PyTorch-Lightning, OpenCV, Scikit-learn, Numpy

Softwares

Git, TensorBoard, MuJoCo, ROS, COLMAP, RViz

Publications

Journals (RA-L, Machine Learning)

- **Haresh Karnan**, Anirudh Nair, Xuesu Xiao, Garrett Warnell, Soeren Pirk, Alexander Toshev, Justin Hart, Joydeep Biswas, Peter Stone. “Socially Compliant Navigation Dataset (SCAND): A Large-Scale Dataset of Demonstrations for Social Navigation”, *Robotics and Automation Letters*, (RA-L 2022).
- Josiah Hanna, **Haresh Karnan**, Siddharth Desai, Garrett Warnell, Peter Stone. “Grounded action transformation for sim-to-real reinforcement learning”, *Springer, Machine Learning*, 2021.

Conference Proceedings (NeurIPS, IROS, ICRA)

- **Haresh Karnan**, Kavan Singh Sikand, Pranav Atreya, Sadegh Rabiee, Xuesu Xiao, Garrett Warnell, Joydeep Biswas, Peter Stone. “VI-IKD: High-Speed Accurate Off-Road Navigation using Learned Visual-Inertial Inverse Kinodynamics” *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2022)*.
- Pranav Atreya, **Haresh Karnan**, Kavan Singh Sikand, Sadegh Rabiee, Xuesu Xiao, Garrett Warnell, Joydeep Biswas, Peter Stone. “High-Speed Accurate Robot Control using Learned Forward Kinodynamics and Non-linear Least Squares Optimization” *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2022)*.
- **Haresh Karnan**, Garrett Warnell, Faraz Torabi, Peter Stone. “Adversarial Imitation Learning from Video using a State Observer”, *IEEE International Conference on Robotics and Automation (ICRA 2022)*.
- **Haresh Karnan**, Garrett Warnell, Xuesu Xiao, Peter Stone. “VOILA: Visual-Observation-only Imitation Learning for Autonomous Navigation”, *IEEE International Conference on Robotics and Automation (ICRA 2022)*.
- **Haresh Karnan**, Siddharth Desai, Josiah Hanna, Garrett Warnell, Peter Stone. “Reinforced grounded action transformation for sim-to-real transfer”, *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2020)*.
- **Haresh Karnan**, Siddharth Desai, Josiah Hanna, Garrett Warnell, Peter Stone. “Stochastic grounded action transformation for robot learning in simulation”, *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2020)*. *Joint first author*.
- **Haresh Karnan**, Siddharth Desai, Ishan Durugkar, Josiah Hanna, Garrett Warnell, Peter Stone. “An Imitation from Observation Approach to Transfer Learning with Dynamics Mismatch”, *Advances in Neural Information Processing Systems (NeurIPS 2020)*. *Joint first author*.

- **Haresh Karnan**, Raman Goyal, Manoranjan Majji, Puneet Singla, Robert Skelton. “Visual feedback control of tensegrity robotic systems”, *IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2017)*.

Patents

- Alan Atherton, Umit Batur, **Haresh Karnan**, Kishor Bhalerao, Harshavardhan Shirolkar. “Systems and methods for utilizing images to determine the position and orientation of a vehicle”, *US20210240195A1*.

Magazines, Workshops, Symposiums

- Anthony Francis, et al. “Principles and Guidelines for Evaluating Social Robot Navigation Algorithms”, *AAAI 2023 Spring Symposium*, **Nominated for Best Paper Award**.
- **Haresh Karnan**, Elvin Yang, Daniel Farkash, Garrett Warnell, Joydeep Biswas, Peter Stone. “Self-Supervised Terrain Representation Learning from Unconstrained Robot Experience”, *Workshop on Pretraining for Robotics (PT4R), ICRA 2023*.
- Elvin Yang, **Haresh Karnan**, Garrett Warnell, Joydeep Biswas, Peter Stone. “Wait, That Feels Familiar: Learning to Extrapolate Human Preferences for Preference-Aligned Path Planning”, *Workshop on Pretraining for Robotics (PT4R), ICRA 2023*.
- **Haresh Karnan**, Anirudh Nair, Xuesu Xiao, Garrett Warnell, Soeren Pirk, Alexander Toshev, Justin Hart, Joydeep Biswas, Peter Stone. “Socially CompliAnt Navigation Dataset (SCAND): A Large-Scale Dataset Of Demonstrations For Social Navigation”, *Workshop on Social Navigation, ICRA 2022*.
- **Haresh Karnan**, Garrett Warnell, Xuesu Xiao, Peter Stone. “VOILA: Visual Observation-only Imitation Learning for Autonomous navigation”, *ML4NAV Spring Symposium, AAAI 2021*.
- **Haresh Karnan**, Siddharth Desai, Ishan Durugkar, Josiah Hanna, Garrett Warnell, Peter Stone. “An imitation from observation approach to sim-to-real transfer”, *2nd Workshop on Closing the Reality Gap in Sim2Real Transfer for Robotics, RSS 2020. Joint first Author*.
- Xuesu Xiao et al. “Autonomous Ground Navigation in Highly Constrained Spaces: Lessons Learned From the Benchmark Autonomous Robot Navigation Challenge at ICRA 2022”, *Robotics and Automation Magazine, RA-M 2022*.
- Rishi Shah, Yuqian Jiang, **Haresh Karnan**, Gilberto Briscoe-Martinez, Dominick Mulder, Ryan Gupta, Rachel Schlossman, Marika Murphy, Justin W. Hart, Luis Sentis, Peter Stone. “Solving Service Robot Tasks: UT Austin Villa@ Home 2019 Team Report”, *AI-HRI Symposium, AAAI 2019*.

Master’s Thesis

- “Design and Control of a Tensegrity Prism Manipulator”, Texas A&M University College Station, July 2018.

Invited Talks

- “Learned Locomotion for Mobile Robots: Addressing Dynamics Mismatch and Utilizing Demonstrations”, Google Research, June 2022.
- “Aligning Robot Navigation Behaviors with Human Preferences”, Bosch AI Research, July 2023.
- “Enabling Self-Sufficient Robot Learning for Real-World Locomotion”, Sony AI Research, August 2023.

Service

Reviewer	AAAI, RA-L, NeurIPS, ICRA, IROS, CVPR ’23, ICML ’23, AI-HRI.
Program Committee	IRMAS, SAC ’24.

References

- Peter Stone (pstone@cs.utexas.edu)
- Garrett Warnell (garrett.a.warnell.civ@army.mil)
- Joydeep Biswas (joydeepb@cs.utexas.edu)
- Ashish Deshpande (ashish@austin.utexas.edu)
- Anca Dragan (anca@berkeley.edu)
- Farshid Alambeigi (Farshid.Alambeigi@austin.utexas.edu)