Haresh Karnan

Austin TX, USA

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Education

The University of Texas at Austin
Austin, TX, USA

PH.D. IN ARTIFICIAL INTELLIGENCE AND ROBOTICS (ADVISED BY DR.PETER STONE)
August. 2018 - August. 2023

- Research Areas: Reinforcement Learning, Sim-to-Real, Learning from Human Feedback, Computer Vision, Robotics.
- Graduate Courses: Reinforcement Learning, Autonomous Robots, Deep Learning, Machine Learning, Neural Networks.
- Affiliations: Peter Stone, Learning Agents Research Group (LARG).

Texas A&M University
College Station, TX, USA

MS. IN ROBOTICS (ADVISED BY DR.ROBERT SKELTON)
August. 2016 - July. 2018

- Research Areas: Control Theory, Computer Vision, Robotics.
- Graduate Courses: Computer Vision, Optimal Control, Estimation Theory, Probabilistic Robotics, Artificial Intelligence.

National Institute of Technology, Tiruchirappalli
Tiruchirappalli, TN, India

B.TECH. IN INSTRUMENTATION AND CONTROL ENGINEERING
June. 2012 - July. 2016

- Undergraduate Courses: Computer Vision, Data Structures and Algorithms, Linear Control, Neural Networks, Pattern Recognition.

Work Experience

Amazon DEX Robotics (Amazon Scout)
Austin, TX, USA

APPLIED SCIENTIST INTERN
May. - Aug. 2019/20/21

[VISUAL REPRESENTATION LEARNING]
- Implemented a contrastive learning-based visual representation learning algorithm for coarse robot localization using image retrieval.
- Improved localization accuracy rate by 32% by successfully learning weather and lighting invariant visual representations.
- Deployed the learned visual feature extractor on an Amazon Scout robot, integrating it with the localization stack.

[DEEP LEARNING FOR POSE ESTIMATION]
- Developed and benchmarked deep learning-based keypoint features for localizing Amazon Scout package delivery robots.
- Achieved over 55% improvement in fine pose estimation accuracy by implementing visual 3D localization in unstructured environments.
- Improved real-time inference rate by 25% using mobile architectures, without sacrificing accuracy.

[DEEP GENERATIVE LEARNING FOR robot localization]
- Developed a novel deep generative adversarial algorithm for monocular robot localization in sidewalks.
- Benchmarked our novel approach with existing visual localization pipelines and achieved a 30% improvement in localization accuracy.
- Filed and published a patent at USPTO, describing the innovative aspects of our approach.

Projects

UT AUSTIN'S ROBOCUP@HOME TEAM - AUSTINVILLA@HOME
Jan. 2019 - Present

- Participated in RoboCup 2019 and 2021 representing AustinVilla@Home and won third place 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 objects.

UT AUSTIN'S ROBOCUP STANDARD PLATFORM LEAGUE - ROBOSOCCER TEAM - AUSTINVILLA
Sep. 2019 - Present

- Published 3 algorithms on the Sim-to-Real problem of transferring a walk policy from simulation to a real-world NAO humanoid robot.
- Modelled real-world transitions as a stochastic MDP and used action transformation to modify the black-box SimSpark simulator.
- Successfully transferred a bipedal robot walk policy from simulation to real-world, adapting it for bumpy terrain. **[Video]**

Publications & Patent

SPRINGER, MACHINE LEARNING   *Areas : [Reinforcement Learning, Sim-to-Real, Robotics]*

- "Grounded Action Transformation for Sim-to-Real Reinforcement Learning", Josiah Hanna, Haresh Karnan, et al., Springer, Machine Learning, 2021. **[Paper]**

NEURAL INFORMATION PROCESSING SYSTEMS (NEURIPS)   *Areas : [RL, Imitation Learning, Sim-to-Real, Robotics]*

- "An Imitation from Observation Approach to Transfer Learning with Dynamics Mismatch", Haresh Karnan, et al., Neural Information Processing Systems, 2020. **[Paper]**

INTERNATIONAL CONFERENCE ON INTELLIGENT ROBOTS AND SYSTEMS (IROS)   *Areas : [RL, Sim-to-Real, Vision, Robotics]*

- "Socially Compliant Navigation Dataset (SCAND): A Large-Scale Dataset of Demonstrations for Social Navigation", Haresh Karnan, Peter Stone, et al., RA-L 2022. **[Paper]**
- "VI-IKD: High-Speed Accurate Off-Road Navigation using Learned Visual-Inertial Inverse Kinodynamics", Haresh Karnan, Peter Stone, et al., IROS 2022. **[Paper]**
- "Stochastic Grounded Action Transformation for Robot Learning in Simulation", Haresh Karnan, Peter Stone, et al., IROS 2020. **[Paper]**
- "Reinforced Grounded Action Transformation for Sim-to-Real Transfer", Haresh Karnan, Peter Stone, et al., IROS 2020. **[Paper]**
- "Visual Feedback Control of Tensegrity Robotic Systems", Haresh Karnan, Robert Skelton, et al., IROS 2017. **[Paper]**

INTERNATIONAL CONFERENCE ON ROBOTICS AND AUTOMATION (ICRA)   *Areas : [Imitation Learning, RL, Computer Vision]*

- "VOILA: Visual Observation-only Imitation Learning for Autonomous navigation", Haresh Karnan, Peter Stone, et al. ICRA 2021. **[Paper] [Video]**
- "Adversarial Imitation Learning from Video using a State Observer", Haresh Karnan, Peter Stone, et al. ICRA 2021. **[Paper] [Video]**

PATENT
- Systems and methods for utilizing images to determine the position and orientation of a vehicle (work done as an intern at Amazon Scout).**[Link]**

Skills

- Languages: C++, Python, Bash
- Libraries: OpenCV, PyTorch, PyTorch-Lightning, ROS, scikit-learn
- Software: TensorBoard, MuJoCo, RViz, Gazebo, Git, COLMAP