Varshith Sreeramdass

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Research Interests

I wish to develop robots capable of collaborating with humans. To that end, my interest lies in algorithmic methods related to Reinforcement Learning, Learning from Demonstrations, and domain/Sim-to-Real transfer.

Experience & Education

Georgia Institute of Technology (GaTech) *Atlanta, US*

MS in Computer Science | Specialization in Computer Perception and Robotics | GPA: 4.0 / 4.0 *2022 - 2024**

- Working on Human-Robot Collaboration in racquet sports with **Prof. Matthew Gombolay**.
- Coursework: DL for Robotics, Mobile Manipulation, ML with Graphs, Humans and ML. **Expecting*

Frontier Robotics, Honda Innovative Research Excellence (R&D) *Tokyo, Japan*

Research Engineer *2019 - 2022*

- Worked on Classical Control and Deep Reinforcement Learning for Dexterous Manipulation.

Indian Institute of Technology Bombay (IITB) *Mumbai, India*

B.Tech. in Computer Science and Engineering (with Honors, Thesis) | GPA: 8.72 / 10 *2015 - 2019*

- Thesis on out-of-distribution detection and active learning advised by **Prof. Sunita Sarawagi**.
- Coursework: Advanced ML, Foundations of Intelligent and Learning Agents, Organization of Web Information, Neuromorphic Engineering, Computer Graphics.

Publications

[P1] **Generalized Behavior Learning from Diverse Demonstrations**
V. Sreeramdass, R. R. Paleja, L. Chen, S. van Waveren, and M. Gombolay.
First workshop on Out-of-Distribution Generalization in Robotics at CoRL 2023 **(Oral)**. **[Paper] [Code] [Poster]**

Key Research

Learning Human-Robot Collaboration in Doubles Tennis from Demonstrations *GaTech*

Prof. Matthew Gombolay *Aug '22 - Present*

- Developing imitation learning methods for robot-partner policies from **diverse human-human demonstrations**.
- Evaluated generative latent-space-based methods for generalization to **novel collaborative behaviors**.
- Proposed a novel latent space regularization scheme to address arbitrary and task-misaligned diversity objectives and showed **improved generalization performance of 11%** across three continuous control domains (see [P1]).
- Extending proposed method for evaluation with real-world manipulation and doubles tennis involving real humans.

Dexterous In-Hand Manipulation using Data driven Deep Reinforcement Learning *Honda R&D*

Akinobu Hayashi, Tadaaki Hasegawa *Apr '20 - Aug '21*

- Evaluated baseline, existing demo-based and offline Deep RL methods in simulation on dexterous In-Hand Manipulation tasks involving **transitions among tripod, precision and power grasps** of cylindrical, cuboidal objects.
- Collected expert demonstrations using manually designed controllers, and exploration data with noisy behaviour-cloned policies, on **real in-house prototype Robot Hand** with motion capture for object pose tracking.
- Deployed RL on real setup to achieve tolerance to init. noise of ranges 4cm and 30° in two tasks resp. **[PR] [Video]**

Exploring Policy Structure for Real-World Robotic Manipulation Control *Honda R&D*

Prof. Takayuki Osa, Akinobu Hayashi, Tadaaki Hasegawa *Apr '20 - Jun '22*

- Explored Deep RL frameworks with policies that operate (1) parameterized Dynamic Motion Primitives with **inferable goal, duration**; (2) a scripted state-based controller with **residual commands** and controlled state-transitions.
- Investigated variants involving (1) primitive interruption heuristics, inference cost optimization, (2) hybrid policies with continuous and discrete action spaces, and approximate models for articulated objects for sim-to-real transfer.
- Demonstrated robustness of residual policy on coke-can opening to init. noise of ranges 5mm (sim) and $\sim$3mm (real).

Leadership Experience

Teaching Assistantships

Interactive Robot Learning — *GaTech*

- Offerings of Fall 2022, Spring 2024, taught by Prof. Matthew Gombolay.

Introduction to Cognitive Science — *GaTech*

- Offering of Fall 2023, taught by Prof. Keith McGreggor.

Software Systems Lab — *IITB*

- Offering of Fall 2018, taught by Prof. Soumen Chakrabarti
- Delivered guest lectures on Build Tools and Introduction to Android Development.
- Awarded 'Certificate of Excellence' for the Month of Oct '18 in the CSE Dept.

Synergy From Diversity — *Honda R&D*

Frontier Robotics (Division) — *Apr '21 - Apr '22*

- Co-established a working group to promote cultural sensitivity among different nationalities, and communication in the context of remote work during COVID-19. Organized language exchange sessions and sensitivity workshops.

Academic Mentor — *IITB*

CSE Department Academic Mentorship Program — *May '18 - May '19*

- Mentored 7 sophomore students, helped coordinate solutions to common academic problems with CSE Dept.
- Advised a back-logged student under the Academic Rehabilitation Program.

Student Volunteer — *GaTech*

Conference on Robot Learning, Atlanta, US — *Nov '23*

Skills

Algorithms Online RL: SAC, TD3, PPO. Unsupervised RL: DIAYN, CSD. Data-based/Offline RL: AWAC, DAPG, GAIL/AIRL.

Robotics Frameworks ROS, MoveIt, PyByllet, MuJoCo (basic), Pinocchio (basic)

ML Libraries PyTorch (Core, Lightning, Geometric), TensorFlow (1, 2), CUDA (basic).

Miscellaneous Git, pybind11, OpenGL, LaTeX.

Minor Projects GNNs for cancer detection from tissue images, VAEs for Relational Representation Learning in multi-object scenes; LSTMs for Music Synthesis; Deep Kalman Filters for Time Series Forecasting; RL of Spiking Neural Networks for Inverse Pendulum.

Other Research

Domain Adaptation of Cloud NLP Services though Word Substitutions — *IITB*

Prof. Sunita Sarawagi, Prof. Soumen Chakrabarti | Thesis — *July '18 - May '19*

- Adaptation of cloud NLP services with sub-optimal performance on client domains with obscure tokens.
- Built **contextual token substitution** model based on ELMO language model architecture to adapt input sentences.
- Employed RL with sentence, token level rewards based on discrepancy b/w true labels and predictions from service.
- Surveyed use of sentiment aware embeddings for improving exploration for sentiment classification. **[Report]**

Out-of-Distribution metrics for Active Domain Adaptation — *IITB*

Prof. Sunita Sarawagi, Prof. Soumen Chakrabarti — *July '18 - May '19*

- Evaluated out-of-distribution (OOD) detection methods involving image classifiers: likelihood temperature scaling (TS), Variational Information Bottlenecks, multi-label and calibrated NNs, perturbation based detectors (ODIN).
- Investigated applicability of OOD-ness as a **proxy for informativeness** of data samples in Deep Active Learning.
- Extended TS, ODIN to sequence inputs for Active Domain Adaptation in Named Entity Recognition. **[Report]**

Miscellaneous

I speak English, Japanese (JLPT N3 level proficiency), Hindi and Telugu. I spend my free time experimenting with cooking, occasionally hiking, collecting vintage vinyl, and learning the harmonica.