Ishan Durugkar

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EDUCATION

PH.D. COMPUTER SCIENCE (2017+)
THE UNIVERSITY OF TEXAS AT AUSTIN, USA
Research areas: Reinforcement Learning, Multi-agent Reinforcement Learning, Robotics, Imitation Learning, Deep Learning
Affiliations: Peter Stone, Learning Agents Research Group (LARG)

M.S. COMPUTER SCIENCE (2014 – 2017)
UNIVERSITY OF MASSACHUSETTS AMHERST
Research Areas: Deep Learning, Reinforcement Learning, Generative Adversarial Networks
GPA: 3.97
Affiliations: Sridhar Mahadevan, Autonomous Learning Lab (ALL)

B.ENGG. COMPUTER ENGINEERING (2007 – 2013)
MAHARASHTRA INSTITUTE OF TECHNOLOGY, INDIA
Research and Extracurricular interests: Robotics, Swarm techniques, non-convex optimization

BIO & RESEARCH STATEMENT

I am a PhD candidate in the Department of Computer Science at the University of Texas at Austin. I am part of the Learning Agents Research Group (LARG) and advised by Prof. Peter Stone. My research focuses on the sub-field of Machine Learning called **Reinforcement Learning**. My doctoral thesis will focus on improving RL algorithms by controlling the data they generate. In particular I use the **estimation and control of the visitation distributions** induced by reinforcement learning agents, such as the distribution of states they visit, or the distribution of transitions they experience. I have utilized these approaches for situations beyond imitation learning, such as **goal-conditioned RL**, **sim-to-real transfer**, and multi-agent RL.

Additional directions that I have worked on are optimization perspectives of TD learning, considering agent preferences in multi-agent RL, and some applications of RL (for example, learning a policy to navigate knowledge bases), in addition to projects focused on deep learning.

Apart from these research interests, I also coordinate the weekly **RL Reading Group** with participation across the University. I also participate in the **RoboCup Standard Platform League** as part of the UT Austin Villa team. Here I work with the Nao robots, and focus on their vision system for the competition, along with using it as a testbed for research on sim-to-real transfer.

In Summer 2021, I interned with **DeepMind**, where I worked with Volodymyr Mnih on unsupervised RL. I have also interned with **Microsoft Research** in Redmond, WA, in the Summer of 2018, where I worked with Adith Swaminathan and Matthew Hausknecht on figuring out how to help developers train RL agents.

RESEARCH WORK EXPERIENCE

Research Assistant
THE UNIVERSITY OF TEXAS AT AUSTIN   2017 +
Assisted and authored research with UT Austin faculty and other graduate students on various projects. Primary research focus has been on Reinforcement Learning with different projects focusing on different aspects of this problem, including optimization, human feedback, sim-to-real transfer, and multi-agent RL.

Research Scientist Intern
DEEPMIND   Summer 2021
Mentored by Volodymyr Mnih in the Discovery team at DeepMind. Focus on research and development of deep reinforcement learning algorithms, specifically unsupervised RL and learning of skillful policies in the absence of reward signals from the environment. Evaluation of the learned skills on the Atari benchmark.

Research Intern
MICROSOFT RESEARCH (MSR), REDMOND   Summer 2018
With Adith Swaminathan and Matthew Hausknecht, research into approaches to improve ease of developing RL agents. Focused on incorporating multiple different feedback channels into learning the agent policy. Specifically, leveraged demonstrations to speed up learning of a policy gradient based agent.

Research Assistant
UNIVERSITY OF MASSACHUSETTS AT AMHERST   2015–2017
Research on various topics including: *(1)* Generative Adversarial Networks (GANs) and Variational Auto-Encoders (VAEs), *(2)* temporal abstractions for actions in Deep RL, *(3)* manifold learning on graphs, and *(4)* learning policies to navigate large knowledge bases.

Research Member
MAHARASHTRA INSTITUTE OF TECHNOLOGY   2013
Research on non-convex optimization using swarm techniques.

Other Work Experience

Software Engineering Intern
Amazon Comixology   Summer 2015

Implemented certain components of the Comixology continuous integration pipeline. Developed a build system based on Ruby, PHP and ANT. Enabled developers to run Unit, Integration and Functional Tests in a single setting. Complete development of this system and integration into the development process.

Data Scientist – Research Assistant
UMass Amherst Alumni Association   2015 – 2016

Used data aggregation, cleaning and analysis along with machine learning techniques to identify and better engage alumni with on campus events and fund raising.

Software Engineer
Microsoft India   2013 – 2014

As part of the Code Search team in Visual Studio Online, implemented a prototype of code search based on Elasticsearch, which was then approved for further development. Participated in the effort to scale the prototype to integrate with Visual Studio Online.

Computing skills

Python (proficient); C++ (intermediate); Experience with various NN training libraries (Tensorflow, PyTorch, Theano); HPC clusters; Distributed NN Training (using Condor, Slurm, and the Azure system at MSR).

Relevant Coursework

The University of Texas at Austin	Reinforcement Learning, Advanced Robotics, Optimization
University Of Massachusetts Amherst	Advanced Machine Learning, Deep Learning, Probabilistic Graphical Models, Optimization, Advanced Algorithms

Robotics Competitions

RoboCup Standard Platform League
UT Austin Villa   2019 - 2022

Quarter-finalists 2019, 2022, 4rd place in 2021

ABU Asia-Pacific Robot Contest
Maharashtra Institute of Technology   2010 – 2012

Represented India in 2010 and 2012

Teaching

Teaching Assistant
The University of Texas at Austin   Fall 2019

Reinforcement Learning: Theory and Practice

Teaching Assistant
UMass Amherst   2015 – 2017

- Applied Machine Learning
- Distributed and Operating Systems

Reviewing Experience

Academic Conferences:
- AAAI Conference on Artificial Intelligence   2021, 2022
- International Conference on Learning Representations (ICLR)   2021, 2022 - *Highlighted Reviewer*
- Conference on Neural Information Processing Systems (NeurIPS)   2016, 2020, 2021, 2022
- International Conference on Machine Learning (ICML)   2021, 2022
- Conference on Lifelong Learning Agents (CoLLAs)   2022 - *Inaugaral Program Committee*
- International Conference on Artificial Intelligence and Statistics (AISTATS)   2022
- The Conference on Robot Learning (CoRL)   2020
- International Joint Conferences on Artificial Intelligence (IJCAI)   2020, 2021

Journals:
- Journal of Artificial Intelligence Research (JAIR)   2022
- IEEE Transactions on Neural Networks and Learning Systems (TNNLS)   2020, 2021, 2022

Workshops:
- Lifelong Machine Learning   ICML 2020
- Multi-Task and Lifelong Reinforcement Learning   ICML 2019
- Neverending learning workshop   ICLR 2021

Organizational

RL Reading Group
UT Austin   Spring 2019 -
Coordinator

Indian Student Association
University of Massachusetts, Amherst   Fall 2015 – Fall 2016
Vice-President of the Indian Student Association at the University of Massachusetts, Amherst.

Publications

Conference Proceedings

[Dur+21a]   Ishan Durugkar et al. "Adversarial Intrinsic Motivation for Reinforcement Learning". In: *Advances in Neural Information Processing Systems*. 2021.

[Des+20]   Siddharth Desai et al. "An Imitation from Observation Approach to Transfer Learning with Dynamics Mismatch". In: *Advances in Neural Information Processing Systems*. *Joint first author*. 2020.

[DLS20]   Ishan Durugkar, Elad Liebman, and Peter Stone. "Balancing Individual Preferences and Shared Objectives in Multiagent Reinforcement Learning". In: *Proceedings of the 29th International Joint Conference on Artificial Intelligence*. 2020, pp. 2505–2511.

[Pav+20a]   Brahma Pavse et al. "Reducing Sampling Error in Batch Temporal Difference Learning". In: *Proceedings of 37th International Conference on Machine Learning, Vienna, Austria*. 2020.

[Das+18]   Rajarshi Das et al. "Go for a Walk and Arrive at the Answer: Reasoning Over Paths in Knowledge Bases using Reinforcement Learning". In: *International Conference on Learning Representations*. 2018.

[DGM17]   Ishan Durugkar, Ian Gemp, and Sridhar Mahadevan. "Generative multi-adversarial networks". In: *International Conference on Learning Representations*. 2017.

[DS17a]   Ishan Durugkar and Peter Stone. "TD Learning with Constrained Gradients". In: *Proceedings of the Deep Reinforcement Learning Symposium, NIPS 2017*. Long Beach, CA, USA, Dec. 2017.

[PGD17]   Mario Parente, Ian Gemp, and Ishan Durugkar. "Unmixing in the presence of nuisances with deep generative models". In: *2017 IEEE International Geoscience and Remote Sensing Symposium (IGARSS)*. IEEE. 2017, pp. 5189–5192.

[Tho+17]   Philip S Thomas et al. "Predictive off-policy policy evaluation for nonstationary decision problems, with applications to digital marketing". In: *Proceedings of the Thirty-First AAAI Conference on Artificial Intelligence*. 2017, pp. 4740–4745.

[KDK13]   Anand J Kulkarni, Ishan P Durugkar, and Mrinal Kumar. "Cohort intelligence: a self supervised learning behavior". In: *2013 IEEE international conference on systems, man, and cybernetics*. IEEE. 2013, pp. 1396–1400.

Workshops and Symposium

[Wan+22]   Caroline Wang et al. "DM ^{2}: Distributed Multi-Agent Reinforcement Learning via Distribution Matching". The Multi-disciplinary Conference on Reinforcement Learning and Decision Making. 2022.

[Dur+21b]   Ishan Durugkar et al. "Wasserstein Distance Maximizing Intrinsic Control". NeurIPS Deep Reinforcement Learning Workshop. 2021.

[Pav+20b]   Brahma S. Pavse et al. "On Sampling Error in Batch Action-Value Prediction Algorithms". In the Offline Reinforcement Learning Workshop at Neural Information Processing Systems (NeurIPS), December 2020. Dec. 2020.

[Dur+19]   Ishan Durugkar et al. "Multi-Preference Actor Critic". The Multi-disciplinary Conference on Reinforcement Learning and Decision Making. 2019.

[DS18]   Ishan Durugkar and Peter Stone. "Adversarial goal generation for intrinsic motivation". AAAI Student Abstracts. 2018.

[DS17b]   Ishan Durugkar and Peter Stone. "TD learning with constrained gradients". NeurIPS Deep Reinforcement Learning Symposium. 2017.

Preprints

[Nar+22]   Sai Kiran Narayanaswami et al. *Towards a Real-Time, Low-Resource, End-to-end Object Detection Pipeline for Robot Soccer*. to be published in Proceedings of RoboCup 2022: Robot World Cup (Bangkok, Thailand), **nominated for best paper**. 2022.

[Dur+16]   Ishan P Durugkar et al. *Deep reinforcement learning with macro-actions*. arXiv preprint 1606.04615. 2016.

[Gem+16a]   Ian Gemp et al. *Deep Generative Models for Spectroscopic Analysis on Mars*. ResearchGate. 2016.

[Gem+16b]   Ian Gemp et al. *Inverting variational autoencoders for improved generative accuracy*. arXiv preprint 1608.05983. 2016.