Anuj Mahajan

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Research Interests

Reinforcement Learning (RL), Learning Theory, Generalization in Machine Learning, Approximate RL, Never-Ending Learning, Information Theory, Game Theory

Selected Publications[+]

Anuj Mahajan, Mikayel Samvelyan, Lei Mao, Viktor Makoviychuk, Animesh Garg, Jean Kossaifi, Shimon Whiteson, Yuke Zhu, and Animashree Anandkumar. TESSERACT: Tensorised actors for multi-agent reinforcement learning. In *Thirty-eighth International Conference on Machine Learning*. 2021 **[ICML]**.

Adam Stooke, Anuj Mahajan, Catarina Barros, Charlie Deck, Jakob Bauer, Jakub Sygnowski, Maja Trebacz, Max Jaderberg, Michael Mathieu, Nat McAleese, Nathalie Bradley-Schmieg, Nathaniel Wong, Nicolas Porcel, Roberta Raileanu, Steph Hughes-Fitt, Valentin Dalibard, and Wojciech Marian Czarnecki. Open-ended learning leads to generally capable agents. 2021 **[DeepMind Tech report]**.

Tarun Gupta, Anuj Mahajan, Bei Peng, Wendelin Boehmer, and Shimon Whiteson. UNEVEN: Universal value exploration for multi-agent reinforcement learning. In *Thirty-eighth International Conference on Machine Learning*. 2021 **[ICML]**.

Tonghan Wang, Tarun Gupta, Anuj Mahajan, Bei Peng, Shimon Whiteson, and Chongjie Zhang. Rode: Learning roles to decompose multi-agent tasks. In *Ninth International Conference on Learning Representations*. 2021 **[ICLR]**.

Anuj Mahajan, Tabish Rashid, Mikayel Samvelyan, and Shimon Whiteson. MAVEN: Multi-agent variational exploration. In *Thirty-third Conference on Neural Information Processing Systems*. 2019 **[NeurIPS]**.

Matthew Fellows*, Anuj Mahajan*, Tim GJ Rudner, and Shimon Whiteson. VIREL: A variational inference framework for reinforcement learning. In *Thirty-third Conference on Neural Information Processing Systems*. 2019 **[NeurIPS]**.

Anuj Mahajan and Theja Tulabandhula. Symmetry detection and exploitation for function approximation in deep RL. In *Proceedings of the 16th Conference on Autonomous Agents and MultiAgent Systems*. International Foundation for Autonomous Agents and Multiagent Systems, 2017 **[AAMAS]**.

Happy Mittal, Anuj Mahajan, Vibhav G Gogate, and Parag Singla. Lifted inference rules with constraints. In *Advances in Neural Information Processing Systems 28*, pages 3501–3509. Curran Associates, Inc., 2015 **[NeurIPS]**.

Anuj Mahajan, Sharmistha Jat, and Shourya Roy. Feature selection for short text classification using wavelet packet transform. In *Proceedings of the Nineteenth Conference on Computational Natural Language Learning*, pages 321–326. Association for Computational Linguistics, 2015 **[CoNLL]**.

[+] Updated list available at Google Scholar: here
* Equal contribution

Education

2017–Current **Doctor of Philosophy in Computer Science**, *University of Oxford*, U.K., Supervisor: Prof. Shimon Whiteson.

2011–2016 **Master of Technology in Computer Science & Engg (Dual degree)**, *Indian Institute of Technology*, Delhi, **Thesis** : Exploring new techniques for MAP Inference in MRFs.

2011–2016 **Bachelor of Technology in Computer Science & Engg (Dual degree)**, *Indian Institute of Technology*, Delhi.

Work Experience

Industrial

2021 **Research Scientist Intern**, *DeepMind*, London, UK.
Open Ended Learning Systems

2020-2021 **Research Intern**, *J.P. Morgan Chase*, London, UK.
Safe Reinforcement Learning for long term decision making with constraints.

2019-2020 **Research Intern**, *NVIDIA*, Santa Clara, USA.
Multi-Agent Reinforcement Learning using tensorised function approximations.

2016-2017 **Budding Scientist**, *Conduent Labs India (erstwhile Xerox Research Centre India)* .
Worked in the Machine Learning and Statistics Group in the following areas:

- Deep Reinforcement Learning
  - Learning symmetries for sample efficient Reinforcement learnring.
- Probabilistic Graphical Models
  - Finding a boosting framework for training Restricted Boltzmann Machines.
  - Analyzing dynamic pricing policy for public transport systems.
- Ranking for Duelling Bandits
  - Using structural properties of the tournament graph of preference matrices having low rank under link transformations for efficient ranking.
- Personalizing applications based on usage
  - Using deep learning for modeling disease dynamics and care from user behavior collected from mobile application.

2014 **Research Intern**, *Xerox Research Centre India*.
Worked on developing feature selection methods and improving the accuracies of machine learning algorithms for short text data like tweets. Developed new method IADWPT for feature selection.

Teaching

2019 **Tutor**.
Tutor for Machine learning for Computer Science & Philosophy undergrads, Trinity term, Hertford College, University of Oxford.

2019 **Teaching Assistant**.
TA for Reinforcement Learning course floated in Hilary term for Doctoral students in Autonomous Intelligent Machines and Systems(AIMS), University of Oxford.

2015-2016 **Teaching Assistant**.
TA for undergrad and graduate bridge courses, IIT Delhi. The work included taking demos for assignments, conducting help sessions and grading answer sheets. TA-ship courses:

- Machine Learning (COL774) Spring semester 2015-16.
- Computer Networks (COL334) Fall semester 2015-16.

Reviewing

NeurIPS Neural Information Processing Systems, 2021, 2020, 2019

ICML International Conference on Machine Learning, 2021

AISTATS Artificial Intelligence and Statistics, 2021

ICLR International Conference on Learning Representations, 2021

JMLR Journal of Machine Learning Research, 2020

Technical skills

Python, Java, C/C++, Prolog, SQL, Ocaml, Assembly

Pytorch, Jax, Tensor Flow, Docker, Matlab, Mathematica, Knime, Android, web2py, Eigen, OpenAI Gym

Relevant Courses

Advanced Machine Learning, Computational Learning theory, Machine Learning, Probabilistic Graphical Models, Adv. Algorithms, Data Mining, Computer Vision, Theory of Computation, Computational Biology, Numeric & Scientific Computing

Scholarships

- Awarded J.P. Morgan AI fellowship 2020.
- Awarded IBM PhD fellowship 2020 (declined).
- Awarded Google Deepmind Scholarship 2017-20 for doctoral studies at University of Oxford.
- Awarded Drapers Hertford graduate Scholarship 2017-20 for doctoral studies at University of Oxford.
- Awarded Microsoft Student Travel Grant for presenting research paper at CoNLL 2015, Beijing, China.
- Awarded Microsoft Student Travel Grant for presenting research paper at NeurIPS 2015, Montreal, Canada.
- Kishore Vaigyanic Protsahan Yojana(KVPY) fellowship awarded by the Department of Science and Technology, Government of India.(**Given to 200 fellows chosen from around one million applicants**)
- Awarded Indian National Association of Engineers (INAE) grant 2015.
- National Talent Search Examination(NTSE) fellowship awarded by NCERT, Department of Education, Government of India.(**500 scholars chosen from around one million applicants**)

Awards & Achievements

- Uber AI resident 2020 (Program rescinded due to covid19)
- Indian Institute of Technology, Delhi, Institute Merit Award : Received the prestigious IITD merit award given to **top 5% students in the institute**.
- Winner, Microsoft 'code.fun.do' : Programming event organized by Microsoft on 16-17/02/2013
- Won the Award of Excellence in Australian National Chemistry Quiz(ANCQ) for securing **All India Rank - 1** for three consecutive years (2006-08)
- Represented the state at Indian National Mathematics Olympiad and Astronomy Olympiad.
- Secured 8th position in the Regional Mathematical Olympiad, 2008 organized by NBHM, Government of India.
- Best Research Poster award at the Xerox open house 2014 poster presentation event.