Anuj Mahajan

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🖰 *Anuj-Mahajan.github.io*

Research Interests

Reinforcement Learning, Generalization in Machine Learning, Multi-Agentness, Game Theory, Computational Learning Theory, Open-Ended / Never-Ending Learning, Safety & Alignment in AI, Large-scale AI, Probability & ML, Optimization

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 Markov Random Fields.

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

Selected Publications[+]

Anuj Mahajan, Mikayel Samvelyan, Tarun Gupta, Benjamin Ellis, Mingfei Sun, Tim Rocktäschel, and Shimon Whiteson. Generalization in cooperative multi-agent systems. 2022 **[arXiv]**.

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]**.

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

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]**.

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

Patents

USA Method and system for predicting requirements of a user for resources over a computer network, Number: US010417578B2

USA Personalizing application interfaces based on usage, Number: US011112950B2

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 **Research Scientist**, *Xerox Research Centre*.
Worked in the Machine Learning and Statistics Group in the following areas:
○ Deep Reinforcement Learning
○ Probabilistic Graphical Models
○ Ranking for Duelling Bandits

2014 **Research Intern**, *Xerox Research Centre*.
Feature selection methods using Wavelet Packet transforms, published in CoNLL 2015.

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, Hilary term, Autonomous Intelligent Machines and Systems (AIMS), University of Oxford.

2015-2016 **Teaching Assistant**.
TA for the following courses at IIT, Delhi:
○ Machine Learning (COL774) Spring semester 2015-16.
○ Computer Networks (COL334) Fall semester 2015-16.

Reviewing

NeurIPS Neural Information Processing Systems, 2022, 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

AAAI Association for the Advancement of Artificial Intelligence, 2022

IEEE IEEE Transactions on Neural Networks and Learning Systems, 2022

ELEC Electronic Commerce Research, Springer, 2018, 2022

TMLR Transactions on Machine Learning Research, 2022

Technical skills

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

Pytorch, Tensor Flow, Jax, Docker, Matlab, Android, Eigen, AWS

Relevant Courses

Advanced Machine Learning, Computational Learning theory, Machine Learning, Probabilistic Graphical Models, Adv. Algorithms, Data Mining, Computer Vision, Theory of Computation, Computational Biology, Molecular Cell Biology

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.

Media

- MIT Technology Review on Open Ended Learning: Link
- DeepMind blog on Generally Capable Agents: Link
- AI plays catch, Two Minute Papers: Link
- Multi-Agent Perspective to AI, talk at GoodAI: Link