Lukas Schäfer

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Research Profile

I am a postdoctoral researcher at Microsoft Research, focusing on efficient learning algorithms for decision-making and multi-agent systems. I am interested in developing algorithms that enable autonomous agents to efficiently learn to solve complex real-world decision-making tasks. My research spans the areas of reinforcement learning, multi-agent systems, and imitation learning, with a particular interest in exploration towards sample-efficient learning and generalisation across tasks.

Work Experience

Microsoft Research Oct 2024 - Present
Postdoctoral Researcher *Cambridge, UK*

My postdoctoral research focuses on developing novel imitation learning algorithms that enable decision making from few demonstrations in complex environments. I also contributed to the recording and data pipeline for training real-time world models deployed on Copilot Labs.
Supervisor: Sergio Valcarcel Macua

Microsoft Research Apr 2023 - Oct 2023
Research Intern *Cambridge, UK*

I conducted an empirical study on the effectiveness of 16 visual encoders, including pre-trained vision foundation models, for imitation learning in modern video games. Our findings were presented at the ALA workshop at AAMAS 2024 [3].
Supervisors: Sam Devlin and Tabish Rashid

Huawei Noah's Ark Lab Jul 2022 - Dec 2022
Research Intern *London, UK*

I researched ensemble models and how they can guide exploration and improve training stability in multi-agent reinforcement learning. The resulting publication was accepted and presented as an **oral paper at AAMAS 2025** [2].
Supervisor: David Mguni

Dematic - Technology and Innovation Nov 2020 - Mar 2021
Research Intern *Remote*

I designed and implemented an efficient multi-agent robotic warehouse simulator and novel multi-agent reinforcement learning algorithms for scalable robotic warehouse logistics. My internship led to a **fellowship funded research collaboration**, four further internship projects, and a publication at IROS 2024 [5].
Supervisors: Aleksandar Krnjaic and Stefano V. Albrecht

Education

University of Edinburgh Dec 2019 - Oct 2024
PhD, Data Science & Artificial Intelligence *Edinburgh, UK*

- Summary: Researched novel exploration methods for deep reinforcement learning in single-agent and multi-agent settings.
- Supervisors: Stefano V. Albrecht (primary) and Amos Storkey (secondary)

University of Edinburgh Sep 2018 - Aug 2019
MSc, Informatics *Edinburgh, UK*

- Grade: Distinction (77.28%)
- Dissertation project: Researched curiosity-driven exploration in multi-agent reinforcement learning.
- Supervisor: Stefano V. Albrecht

Saarland University Oct 2015 - Sep 2018
BSc, Computer Science *Saarbrücken, Germany*

- Grade: 1.2 (within top 5%)
- Dissertation project: Extended Action-Schema-Networks to learn heuristic functions for classical planning using neural networks.
- Supervisor: Jörg Hoffmann

Publications

Citations on Google Scholar: 1,200+

Textbook

[1] S. V. Albrecht, F. Christianos, and **Lukas Schäfer**. *Multi-Agent Reinforcement Learning: Foundations and Modern Approaches*. MIT press, 2024.

Journal and Conference Papers (Peer-Reviewed)

[2] **Lukas Schäfer**, O. Slumbers, S. McAleer, Y. Du, S. V. Albrecht, and D. Mguni. "Ensemble Value Functions for Efficient Exploration in Multi-Agent Reinforcement Learning". In: *AAMAS*. 2025.

[4] A. A. Fernandez, **Lukas Schäfer**, E. Villar-Rodriguez, S. V. Albrecht, and J. D. Ser. "Using Offline Data to Speed-up Reinforcement Learning in Procedurally Generated Environments". In: *Neurocomputing* (2024).

[5] A. Krnjaic, R. D. Steleac, J. D. Thomas, G. Papoudakis, **Lukas Schäfer**, A. W. K. To, K.-H. Lao, M. Cubuktepe, M. Haley, P. Börsting, and S. V. Albrecht. "Scalable Multi-Agent Reinforcement Learning for Warehouse Logistics with Robotic and Human Co-Workers". In: *IROS*. 2024.

[6] T. McInroe, **Lukas Schäfer**, and S. V. Albrecht. "Learning representations for control with hierarchical forward models". In: *Transactions on Machine Learning Research* (2023).

[7] **Lukas Schäfer**, F. Christianos, J. P. Hanna, and S. V. Albrecht. "Decoupled Reinforcement Learning to Stabilise Intrinsically-Motivated Exploration". In: *AAMAS*. 2022.

[8] **Lukas Schäfer**. "Task Generalisation in Multi-Agent Reinforcement Learning". In: *AAMAS, Doctoral Consortium*. 2022.

[9] R. Zhong, D. Zhang, **Lukas Schäfer**, S. V. Albrecht, and J. P. Hanna. "Robust On-Policy Data Collection for Data Efficient Policy Evaluation". In: *NeurIPS*. 2022.

[10] G. Papoudakis, F. Christianos, **Lukas Schäfer**, and S. V. Albrecht. "Benchmarking Multi-Agent Deep Reinforcement Learning Algorithms in Cooperative Tasks". In: *NeurIPS, Datasets and Benchmarks Track*. 2021.

[11] F. Christianos, **Lukas Schäfer**, and S. V. Albrecht. "Shared Experience Actor-Critic for Multi-Agent Reinforcement Learning". In: *NeurIPS*. 2020.

Workshops (Peer-Reviewed)

[3] **Lukas Schäfer**, L. Jones, A. Kanervisto, Y. Cao, T. Rashid, R. Georgescu, D. Bignell, S. Sen, A. T. Gavito, and S. Devlin. "Visual Encoders for Data-Efficient Imitation Learning in Modern Video Games". In: *Adaptive and Learning Agents Workshop at AAMAS*. 2025.

[13] **Lukas Schäfer**, F. Christianos, A. Storkey, and S. V. Albrecht. "Learning Task Embeddings for Teamwork Adaptation in Multi-Agent Reinforcement Learning". In: *Generalization in Planning Workshop at NeurIPS*. 2023.

Theses

[15] **Lukas Schäfer**. "Efficient Exploration in Single-Agent and Multi-Agent Deep Reinforcement Learning". PhD Thesis. University of Edinburgh, 2024.

[16] **Lukas Schäfer**. *Curiosity in Multi-Agent Reinforcement Learning*. Master's Thesis. 2019.

[17] **Lukas Schäfer**. *Domain-Dependent Policy Learning using Neural Networks in Classical Planning*. Bachelor's Thesis. 2018.

Teaching Experience

Textbook Author Mar 2022 - Dec 2024

Designed and wrote an introductory **textbook on multi-agent reinforcement learning** with Stefano V. Albrecht and Filippos Christianos (equal contributions). I also co-designed the accompanying codebase and developed exercises for the Barcelona summer school on multi-agent reinforcement learning (2024).

University of Edinburgh Oct 2019 - Jun 2022
Teaching Assistant *Edinburgh, UK*

Re-designed the Reinforcement Learning course as teaching assistant for three consecutive years (2019 – 2022). Delivered lectures and designed coursework on reinforcement learning (including deep and multi-agent RL) for last year undergraduate and M.Sc. students. Supervised and marked coursework and exam scripts for 100+ students.

Saarland University Sep 2017 - Oct 2017
Voluntary Lecturer and Coach *Saarbrücken, Germany*

Delivered daily lectures on formal languages and predicate logic to 250 participants in the mathematics preparation course for upcoming computer science students. The course received **BESTE-award** for special student commitment 2017 of Saarland University.

Saarland University Oct 2016 - Mar 2017
Teaching Assistant *Saarbrücken, Germany*

Taught functional programming, basic complexity theory, and inductive proofs to first-year undergraduate students in weekly tutorials and office hours. Collectively created learning materials and discussed student progress as part of the whole teaching team. Marked weekly tests, mid-term and final exams.

Supervision and Mentorship Experience

Microsoft Research Apr 2025 - Aug 2025
Supervision of PhD Research Intern *Cambridge, UK*

Supervised PhD research intern Somjit Nath (McGill University/ Mila, Canada) during his 4-month internship. His work designed novel data augmentations for efficient imitation learning in video games.

University of Edinburgh May 2022 - May 2023
Supervision of Visiting PhD Student *Edinburgh, UK*

Supervised visiting PhD student Alain Andres Fernandez (Tecnalia, Spain) during his 3-month research visit and following collaboration. The project researched imitation learning for pre-training and concurrent training of reinforcement learning agents, and resulted in a publication at the **Neurocomputing Journal** [4].

University of Edinburgh Sep 2021 - May 2022
Supervision of Master's Students *Edinburgh, UK*

Supervised two Master's students during their M.Sc. dissertation projects:

- Rujie Zhong: Data Collection for Policy Evaluation in Reinforcement Learning
  Led to publication at **NeurIPS 2022** [9], after presentation at Workshop on Offline Reinforcement Learning (NeurIPS 2021)
- Panagiotis Kyriakou: Reinforcement Learning with Function Approximation in Continuing Tasks: Discounted Return or Average Reward?

Funding

Dec 2019 - Jun 2024	£58,731	**Principal's Career Development Scholarship** PhD scholarship from University of Edinburgh
Apr 2023 - Oct 2023	£12,860	**Microsoft Research internship extension** funding to extend research internship from 3 to 6 months; granted by Xbox after demo of internship project progress
Jul 2022 - Dec 2022	£4,160	**Huawei Noah's Ark Lab internship extension** funding to extend research internship from 4 to 5 months
Sep 2018 - Aug 2019	16,500 €	**DAAD graduate scholarship** postgraduate scholarship from German Academic Exchange Service
Sep 2018 - Aug 2019	£300	**Stevenson Exchange Scholarship** postgraduate scholarship to support studies in Scotland

Awards

Jun 2025 **Best reviewer award** at ICML 2025
Jun 2024 **Best reviewer award** at ICML 2024
Jul 2022 **Best reviewer award** at ICML 2022
Oct 2017 **BESTE-award** for special student commitment 2017 of Saarland University

Academic Engagement

Organisation

UK Multi-Agent Systems Symposium 2025 Jul 2024 - Mar 2025
Lead Organiser *London, UK*

Co-lead organiser of the **UK Multi-Agent Systems Symposium 2025** with 200 participants in collaboration with the Alan Turing Institute and King's College London.

University of Edinburgh Sep 2020 - Sep 2022
RL Reading Group Organiser *Edinburgh, UK*

Organised and hosted RL reading group at University of Edinburgh with speakers from industry (e.g. DeepMind, MSR, FAIR) and academia (e.g. Oxford University, McGill University, NUS)

Invited Talks

Oct 2025 **University of Sheffield, ML Seminar Series**
Decision-Making in Modern Video Games: From Human Play to World Models

Jul 2025 **Belgium-Netherlands Workshop on Reinforcement Learning (BeNeRL)**
Decision Making in Video Games

Nov 2024 **Gazi University Turkey, AI Research & Big Data Seminars**
An Introduction to the Multi-Agent Reinforcement Learning Textbook

May 2024 **Microsoft Research Cambridge**
Efficient and Scalable Decision Making In Complex Environments

Mar 2024 **University of Maryland, MARL Reading Group**
An Introduction to MARL Textbook and EPyMARL Codebase

Feb 2024 **Stanford University, Stanford Intelligent Systems Laboratory**
Sample-Efficient Multi-Agent Reinforcement Learning

Jul 2022 **Berkeley RL Reading Group**
Deep Reinforcement Learning for Multi-Agent Interaction

Reviewing

- 3-time **best reviewer award** for ICML conference (2022, 2024, 2025)
- Journals: Transactions on Machine Learning Research (TMLR, 2024)
- Conferences: NeurIPS (2021, 2022, 2023), ICLR (2026), ICML (2021, 2022, 2023, 2024, 2025), AAMAS (2022, 2023, 2024), RLDM (2025), RLC (2024)
- Workshops: NeurIPS Pre-registration experiment workshop (2020)

Other Engagement

Heidelberg Laureate Forum Sep 2022
Young Researcher Attendee *Heidelberg, Germany*

Selected as one of 100 international young researchers in computer science to participate in the prestigious Heidelberg Laureate Forum where I had the opportunity to network and discuss research with laureates of the most prestigious awards in mathematics and computer science.