Lukas Schäfer

lukaschaefer.com | Google Scholar | lukas.schaefer@microsoft.com

Research Profile

I am a postdoctoral researcher at Microsoft Research, focusing on efficient learning algorithms for decision-making and multi-agent systems. I am a co-author of the first introductory textbook on multi-agent reinforcement learning, and have published in top machine learning venues, including NeurIPS, TMLR, and AAMAS.

Publications

Citations on Google Scholar: 1,300+

Textbook

[1] S. V. Albrecht, F. Christianos, and **Lukas Schäfer**. *Multi-Agent Reinforcement Learning: Foundations and Modern Approaches*. MIT press, 2024, Note: **Downloaded over 50,000 times**.

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.

[3] 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).

[4] 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.

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

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

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

[8] 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.

[9] 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.

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

Workshops (Peer-Reviewed)

[11] **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.

[12] **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.

Work Experience – Current

Postdoctoral Researcher Oct 2024 - Present
Microsoft Research *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

Work Experience – Past

Research Intern Apr 2023 - Oct 2023
Microsoft Research *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 [11].
Supervisors: Sam Devlin and Tabish Rashid

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

Research Intern Nov 2020 - Mar 2021
Dematic - Technology and Innovation *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 [4].
Supervisors: Aleksandar Krnjaic and Stefano V. Albrecht

Education

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

My PhD research focused on novel exploration methods to enable sample-efficient deep reinforcement learning in single-agent and multi-agent settings. I also studied the ability of agents to generalise across tasks, and how meta-learning task representations can facilitate such generalisation.
Supervisors: Stefano V. Albrecht (primary) and Amos Storkey (secondary)

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

My Master's dissertation project researched the efficacy of curiosity-driven exploration for multi-agent reinforcement learning. I also completed advanced modules on reinforcement learning, machine learning, robotics, and game theory.
Supervisor: Stefano V. Albrecht | **Award:** Distinction (77.28%)

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

My Bachelor's dissertation project extended Action-Schema-Networks to learn heuristic functions for classical planning using neural networks. Beyond foundational modules in mathematics and computer science, I completed advanced modules on automated planning, neural networks, and software engineering.
Supervisor: Jörg Hoffmann | **Award:** 1.2 (within top 5%)

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). The textbook has been **downloaded over 50,000 times** since its pre-release in April 2023.

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

Re-designed the Reinforcement Learning course as teaching assistant for three consecutive years (2019 – 2022). Delivered lectures, designed coursework, supervised and marked coursework and exams on reinforcement learning for 100+ last year undergraduate and M.Sc. students.

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

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

Teaching Assistant Oct 2016 - Mar 2017
Saarland University *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

Supervision of PhD Research Intern Apr 2025 - Aug 2025
Microsoft Research *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.

Supervision of Visiting PhD Student May 2022 - May 2023
University of Edinburgh *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** [3].

Supervision of Master's Students Sep 2021 - May 2024
University of Edinburgh *Edinburgh, UK*

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

- Rahat Santosh: Integrating Agent Modelling in Multi-Agent Reinforcement Learning Algorithms
- Rujie Zhong: Data Collection for Policy Evaluation in Reinforcement Learning
  Resulted in main conference publication at **NeurIPS 2022** [8]
- Panagiotis Kyriakou: Reinforcement Learning with Function Approximation in Continuing Tasks: Discounted Return or Average Reward?

Research Community Engagement

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)

Invited Talks

Dec 2025 **ELLIS UnConference, Interactive Learning and Interventional Representations (ILIR) Workshop**
Exploiting State and Action Uncertainty for Imitation Learning using Inverse Dynamics Models

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

Organisation

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

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

Awards

Young Researcher Attendee Sep 2022
Heidelberg Laureate Forum *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.

Open-Source Software Contributions

EPyMARL – Core Contributor

Core contributor to the EPyMARL codebase, an open-source codebase for multi-agent reinforcement learning research. EPyMARL has been developed as part of a benchmarking effort [9] and has since received **over 600 stars on Github**.

MARL Textbook Codebase – Core Contributor

Core contributor to the accompanying codebase to our textbook on multi-agent reinforcement learning [1], an open-source codebase designed for ease of use and teaching in multi-agent reinforcement learning research. Within the first year of its release, the codebase has received **over 550 stars on Github**.

Funding

Awarded 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
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

Contributions to Funding Awards

Royal Academy of Engineering, Industrial Fellowship 2022

My internship project at Dematic initiated and laid the foundation for a multi-year research collaboration funded with **£250,000** through a **Industrial Fellowship of the Royal Academy of Engineering** between Dematic and the University of Edinburgh on scalable multi-agent reinforcement learning for warehouse logistics. The fellowship was held by my primary PhD supervisor, Prof. Stefano V. Albrecht.