# Lukas Schäfer

Lukas Schäfer · lukas-schaefer · LukasSchaefer
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## EDUCATION

### PhD Data Science & Artificial Intelligence — 12/2019 -- Present
University of Edinburgh — Edinburgh, United Kingdom

- Principal supervisor: Dr. Stefano V. Albrecht (Autonomous Agents Research Group)
- Project: Collaborative Exploration in Multi-Agent Reinforcement Learning using Intrinsic Curiosity
- Research: Reinforcement Learning, Multi-Agent Systems, Generalisation, Exploration, Intrinsic Rewards

### M.Sc. Informatics — 09/2018 -- 08/2019
University of Edinburgh — Edinburgh, United Kingdom

- Degree classification: **Distinction** (77.28%)
- MSc thesis: Curiosity in Multi-Agent Reinforcement Learning (74%)
- Received **DAAD** (German Academic Exchange Service) **graduate scholarship** and **Stevenson Exchange Scholarship**
- Modules include: Reinforcement Learning, Algorithmic Game Theory and its Applications, Machine Learning and Pattern Recognition, Probabilistic Modelling and Reasoning, Decision Making in Robots and Autonomous Agents

### B.Sc. Computer Science, minor subject Japanese — 10/2015 -- 09/2018
Saarland University — Saarbrücken, Germany

- Degree classification: grade of **1.2** (German scale) equivalent to UK **1st class honours**
- BSc thesis: Domain-Dependent Policy Learning using Neural Networks in Classical Planning (1.0)

### Abitur 1.0 - Secondary School — 08/2008 -- 06/2015
Warndtgymnasium Geislautern, Völklingen — Geislautern, Germany

## DISSERTATIONS

### M.Sc. Dissertation, University of Edinburgh — 05/2019 -- 08/2019
Autonomous Agents Research Group

- Applied curiosity as intrinsically computed exploration bonuses for multi-agent reinforcement learning (MARL)
- Implemented count- and prediction-based curiosities for value-based and policy-gradient MARL methods using PyTorch
- Evaluated the influence of curiosity on cooperative and competitive MARL under partial observability and sparse rewards in a multi-agent particle environment
- Applied curiosity led to improved stability and convergence of policy-gradient MARL trained with sparse reward signals

### B.Sc. Dissertation, Saarland University — 04/2018 -- 07/2018
Foundations of Artificial Intelligence (FAI) Group

- Transferred domain-dependent policy learning Action-Schema Networks to classical automated planning
- Keras implementation, adjusted training for classical planning and extended the FastDownward planning framework
- Extensive evaluation and analysis was conducted on IPC domains of varying complexity identifying limitations in generalisation and scalability

## SKILLS

**Programming**

Competent
Python • C++ • SML

Familiar
C • Java • Rust • HTML • CSS • Matlab • Bash

**Technologies and Tools**

PyTorch • TensorFlow • Keras • NumPy • UNIX • Git

**Languages**

Native in German • Fluent in English • Intermediate in French • Beginner in Chinese • Beginner in Japanese

## PUBLICATIONS

[1] F. Christianos, **Lukas Schäfer**, and S. V. Albrecht. Shared Experience Actor-Critic for Multi-Agent Reinforcement Learning. In *34th Conference on Neural Information Processing Systems*, 2020.

[2] G. Papoudakis, F. Christianos, **Lukas Schäfer**, and S. V. Albrecht. Comparative Evaluation of Multi-Agent Deep Reinforcement Learning Algorithms, 2020.

## REVIEWING

- Reviewer for **NeurIPS 2020 workshop** "**The pre-registration experiment**: an alternative publication model for machine learning research"

## TEACHING EXPERIENCE

### Teaching Assistant, University of Edinburgh 10/2019 -- 05/2020

Reinforcement Learning, School of Informatics

- **Delivering lectures** and **designing RL coursework** coveringwide range of topics from single- to multi-agent and deep RL
- Marking project and exam for reinforcement learning course
- Advising students on various challenges regarding lecture material and content

### Voluntary Lecturer and Coach, Saarland University 09/2017 -- 10/2017

Mathematics Preparation Course

- Assisted the organization of the mathematics preparation course for upcoming computer science students
- Explained formal languages and predicate logic to $\sim 250$ participants in daily lectures of the first week
- Supervised two groups to provide feedback and further assistance in daily coaching-sessions
- The course received **BESTE-award** for special student commitment 2017 of Saarland University

### Teaching Assistant, Saarland University 10/2016 -- 03/2017

Programming 1, Dependable Systems and Software Group

- Taught first-year students concepts of functional programming, basic complexity theory and inductive correctness proofs in weekly tutorials and office hours
- Collectively created learning materials and discussed student progress as part of the whole teaching team

## PROJECT EXPERIENCE

### Navigation Software Engineer, University of Edinburgh 09/2018 -- 08/2019

HYPED -- University of Edinburgh Hyperloop Team

- Developing navigation system of "The Flying Podsman" Hyperloop prototype using sensor filtering, processing and control techniques to estimate location, orientation and speed of the pod
- Finalist for the SpaceX 2019 Hyperloop competition in California in Summer 2019

### Reinforcement Learning for Soccer Playing, University of Edinburgh 02/2019 -- 03/2019

Project for Reinforcement Learning Lecture

- Implemented several foundational RL methods including value iteration, Q-learning, first-visit Monte Carlo and SARSA for simple control tasks and the half-field-offense (HFO) 2D environment
- Implemented asynchronous 1-step Q-learning with deep Q-networks (DQNs)
- Implemented multi-agent RL methods independent Q-learning, joint action learning and WoLF-PHC controlling two cooperating agents in the HFO environment

### Autonomous Robot Localisation, University of Edinburgh 09/2018 -- 12/2018

Group Project for Robotics: Science and Systems Lecture

- Constructed a four-wheel differential steering mobile robot as group of three for autonomous localisation in a known environment using LEGO aside of technical components including a Raspberry Pi computer
- Implemented particle-filter localisation and obstacle avoidance based on IR and sonar sensors
- Robot successfully managed to navigate through the constructed arena, detect and communicate points of interest using light sensors and return back to its deployment location

[References available on request - Last updated on October 28, 2020]