

# Lukas Schäfer

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## EDUCATION

### PhD Data Science & Artificial Intelligence

University of Edinburgh

12/2019 – Present

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, Exploration, Intrinsic Rewards

### M.Sc. Informatics

University of Edinburgh

09/2018 – 08/2019

Edinburgh, United Kingdom

- ▶ Degree classification: Distinction (77.28%)
- ▶ MSc thesis: Dissertation: Curiosity in Multi-Agent Reinforcement Learning (74%)
- ▶ DAAD (German Academic Exchange Service) graduate 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

Saarland University

10/2015 – 09/2018

Saarbrücken, Germany

- ▶ Degree classification: grade of 1.2 (German scale) equivalent to UK 1<sup>st</sup> class honours
- ▶ BSc thesis: Domain-Dependent Policy Learning using Neural Networks in Classical Planning (1.0)
- ▶ Modules include: Automated Planning, Admissible Search Enhancements, Neural Networks: Implementation and Application, Information Retrieval and Data Mining, Software Engineering, Modern Imperative Programming Languages

### Abitur 1.0 - Secondary School

Warndtgymnasium Geislautern, Völklingen

08/2008 – 06/2015

Geislautern, Germany

## RESEARCH EXPERIENCE

### M.Sc. Dissertation, University of Edinburgh

Autonomous Agents Research Group

05/2019 – 08/2019

- ▶ 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

Foundations of Artificial Intelligence (FAI) Group

04/2018 – 07/2018

- ▶ Transferred domain-dependent policy learning Action-Schema Networks to classical automated planning
- ▶ Implemented the network using Keras, slightly adjusted its 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 Japanese

## TEACHING EXPERIENCE

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### **Teaching Assistant, University of Edinburgh**

**10/2019 – Present**

Reinforcement Learning, School of Informatics

- › Designing reinforcement learning (RL) project covering wide range of topics including dynamic programming, single- and multi-agent RL as well as 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 ~ 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 fundamental concepts of functional programming, basic complexity theory and inductive correctness proofs in weekly tutorials and office hours
- › Marked weekly tests as well as mid- and endterm exams
- › Collectively created learning materials and discussed student progress as part of the whole teaching team

## PROJECT EXPERIENCE

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### **Navigation Software Engineer, University of Edinburgh**

**09/2018 – 08/2019**

HYPED – University of Edinburgh Hyperloop Team

- › Developing navigation system of "The Flying Podman" 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

### **Plagiarism Detection Tool, Saarland University**

**04/2017 – 07/2017**

Group Project for Software Engineering Lecture

- › Researched, planned and built a reliable similarity detection for text & code in Python with language-specific analysis for Python and C as a group of five
- › Designed and implemented a web-based output creation, highlighting similar submissions and plagiarism
- › Our software is now successfully used in our customer's lectures to detect plagiarism cases on Python code