Dr. Christian A. Schroeder de Witt

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Education

University of Oxford, St Catherine's College DPhil in Artificial Intelligence at the Engineering Department (Jan 2017 - Sep 2021) under supervision of Prof Philip Torr • PhD Thesis: *'Coordination and Communication in Deep Multi-Agent Reinforcement Learning.'* Passed viva (defence) in September 2021.

University of Oxford, Kellogg College Master of Science in Computer Science (Oct 2012 - Sept 2013) • *Selected Coursework: Concurrency, Concurrent Programming, Database Systems Implementation, Categorical Quantum Mechanics, Lambda Calculus and Types* • Master thesis under supervision of Prof Bob Coecke: *'The ZX-calculus is incomplete for Quantum Mechanics.'*. • Academically distinguished, master's thesis led to a well-cited publication.

University of Oxford, Exeter College MPhys Physics (Oct 2008 - July 2012) • *Selected Coursework: Theoretical Physics, Laser science and quantum information processing* • Master Thesis under supervision of Prof Ard Louis: *'Genetic Algorithms and Biological Evolution'*. • First class (academically distinguished), master's thesis was awarded Oxford University Tessella Prize. Awarded East Exhibition from 2009 to 2012.

Brandon University, MB 1st year of BMus Music and 2nd year of BSc Physics [double major] (Sep 2007 - Jul 2008) • *Selected Coursework: Applied Concentration (A^+), Calculus IV (A^+), Music Theory (A^+)* . GPA: 4.09/4.3. Inducted into the President's Honour Society. Admitted to four-year piano performance concentration program with an international student scholarship.

TU Kaiserslautern, DE 1st semester of Physics Diploma (2005)
Passed first semester of university physics degree (remote) at age 14 while still at high school.

Current and Future Positions

University of Oxford (Jan 2022 - today)
Postdoctoral Research Assistant, Department of Engineering Science

- 2-year postdoctoral researcher role with Prof Jakob Foerster, funded by the Cooperative AI Foundation.

Scholarships, Awards, Grants and Prizes

- Awarded prestigious **EPSRC IAA Doctoral Impact Fund (2022)** to further develop and deploy secure steganography solutions to end users that I co-invented during my DPhil research.
- Principal grantee on **Microsoft AI for Earth grant (2021)** for AI method development for finding optimal macro-strategies for the net-zero energy transition using deep multi-agent learning and agent-based modeling.
- **Global finalist at Schmidt Science Fellowship competition (2021).** Nominated as one of the University of Oxford's most promising DPhil students and subsequently shortlisted for the final round of this extremely competitive fellowship with a NASA-backed project proposal on climate science and aerosol physics.
- Awarded **Google TPU Research Cloud grant** (2019).
- **Best Idea Award** for "Stratospheric Aerosol Injection as a Deep Reinforcement Learning Problem" by the international Climate Change and AI (CCAI) community, ICML 2019.
- **Oxford University Tessella Prize for Innovation in Software (2012).** Awarded for MPhys thesis "Genetic Algorithms and Biological Evolution" (supervised by Prof Ard Louis)
- **Fitzgerald Prize (2012)** (Exeter College, University of Oxford)
- **Studienstiftung des Deutschen Volkes (2011)**. In Germany the top 0.5% of high school graduates get selected for funding by the German Academic Foundation (also known as German Merit Foundation)
- **Jean McKinnon Scholarship for Solo Piano Performance (2008)**. Awarded a special prize at Brandon Festival at the Arts.

Selected Invited Talks, Guest Lectures and Presentations

- Poster presentation "RainBench: Towards Data-Driven Global Precipitation Forecasting from Satellite Imagery" at AAAI 2021 (remote)
- **Spotlight presentations** "RainBench: Towards Data-Driven Global Precipitation Forecasting from Satellite Imagery" at CCAI and AI4Earth workshops at NeurIPS 2020 (remote)
- Invited talk "Stratospheric Aerosol Injection as a Deep Reinforcement Learning Problem" at NVidia GTC 2020, (San Jose, CA, 2020)
- Invited talk "Multi-Agent Common Knowledge Reinforcement Learning" at Edinburgh Centre For Robotics, UK (Edinburgh, 2020)
- Invited talk "Deep Multi-Agent Reinforcement Learning for Decentralized Continuous Cooperative Control" at SDU UAS drone center (Odense, DK 2020)
- Poster presentation at Neural Information Processing Systems (NeurIPS, Vancouver, 2019)
- **Spotlight presentation** "Stratospheric Aerosol Injection as a Deep Reinforcement Learning Problem" at Climate Change and AI workshop, (ICML 2019, Los Angeles, CA)
- Invited talk "Advances in Cooperative Deep Multi-Agent Reinforcement Learning" at Huawei DaVinci Forum (Shanghai, 2018)

Selected Publications (* denotes equal contribution)

- '*Amortized Rejection Sampling in Universal Probabilistic Programming*', S Naderiparizi, A Scibior, A Munk, M Ghadari, AG Baydin, B Gram-Hansen, CS de Witt, R Zinkov, P Torr, T Rainforth, YW Yeh, F Wood, **AISTATS 2022**
- '*FACMAC: Factored Multi-Agent Centralised Policy Gradients*', B Peng*, T Rashid*, CS de Witt*, PA Kamienny, P Torr, W Boehmer, S Whiteson, **NeurIPS 2021**
- '*RainBench: Towards Data-Driven Global Precipitation Forecasting from Satellite Imagery*', CS de Witt*, C Tong*, V Zantedeschi, D De Martini, A Kalaitzis, M Chantry, D Watson-Parris, P Bilinski, Proceedings of the AAAI Conference on Artificial Intelligence 35:17, **AAAI 2021**
- '*Randomized Entity-Wise Factorization for Deep Multi-Agent Reinforcement Learning*', S Iqbal, CS de Witt, B Peng, W Böhmer, S Whiteson, F Sha, 2020, **ICML 2021**
- '*Multi-Agent Common Knowledge Reinforcement Learning*', CS de Witt*, J Foerster*, G Farquhar, P Torr, W Boehmer and S Whiteson, Advances in Neural Information Processing Systems, 9924-9935. **NeurIPS 2019**
- '*Monotonic Value Function Factorisation for Deep Multi-Agent Reinforcement Learning*', T Rashid*, M Samvelyan*, CS de Witt, Gregory Farquhar, Jakob Foerster and Shimon Whiteson, Journal of Machine Learning Research 21:178, **JMLR 2020**
- '*The Starcraft Multi-Agent Challenge*', M Samvelyan*, T Rashid*, CS de Witt, G Farquhar, N Nardelli, TGJ Rudner, CM Hung, PHS Torr, J Foerster, S Whiteson, **AAMAS 2019**
- '*Efficient Bayesian Inference for Nested Simulators*', B Gram-Hansen, CS de Witt, R Zinkov, S Naderiparizi, A Scibior, A Munk, F Wood, M Ghadari, P Torr, AG Baydin, YW Teh, T Rainforth, **AABI 2019**
- '*QMIX: Monotonic Value Function Factorisation for Deep Multi-Agent Reinforcement Learning*', T Rashid*, M Samvelyan*, CS de Witt, Gregory Farquhar, Jakob Foerster and Shimon Whiteson, **ICML 2018**
- '*The ZX-calculus is incomplete for quantum mechanics*', CS de Witt, Vladimir Zamdzhiev, **Quantum Physics and Logic (QPL) 2014**

Selected Workshop papers and Pre-prints

- '*Is Independent Learning All You Need in the StarCraft Multi-Agent Challenge?*', CS de Witt*, T Gupta*, D Makoviichuk, V Makoviychuk, P Torr, M Sun, S Whiteson, arXiv:2011.09533, 2020
- '*Deep Multi-Agent Reinforcement Learning for Decentralized Continuous Cooperative Control*', CS de Witt*, B Peng*, PA Kamienny, P Torr, W Boehmer and S Whiteson, arXiv:2003.067092020, 2020
- '*RainBench: Towards Data-Driven Global Precipitation Forecasting from Satellite Imagery*', CS de Witt*, C Tong*, V Zantedeschi, D De Martini, A Kalaitzis, M Chantry, D Watson-Parris, P Bilinski, **Spotlight** at both **CCAI and AI4Earth at NeurIPS 2020**, also presented at **EGU 2021** and **ESIP 2021.**
- '*Simulation-Based Inference for Global Health Decisions*', CS de Witt, N Nardelli, A Gambardella, R Zinkov, P Dokania, N. Siddarth, AB Espinosa-Gonzalez, A Darzi, P Torr, AG Baydin
- '*Stratospheric Aerosol Injection as a Deep Reinforcement Learning Problem*' CS de Witt*, T Hornigold*, 2019, **Spotlight Presentation** and **Best Idea Award** at **CCAI at ICML 2019.**
- '*Safe screening for support vector machines*', J Zimmert, CS de Witt, G Kerg, M Kloft **Optimization in Machine Learning (OPT) Workshop at NIPS 2015**

Community contributions

- Reviewer for NeurIPS, ICML, ICLR, IROS, Journal of Artificial Intelligence (AIJ), and others
- Program committee for Cooperative AI Workshop, CCAI, AI4Earth workshops and others
- Member of the European Geosciences Union
- Author of open-source benchmark environments RainBench/PyRain and Multi-Agent Mujoco, co-author of PyMARL and the StarCraft Multi-Agent Challenge.

Academic Visits, Research Internships and Research Assistantships

Armasuisse Cyber Defense Campus [Zurich] (Sep 2020 - Oct 2020)
Visiting Researcher, Host: Dr Martin Strohmeier

- Working on applying deep multi-agent reinforcement learning to botnet detection and adversarial hardening using real-world training data from LockedShields exercises.

School of Geography and the Environment [Oxford] (May 2020 - today)
Part-time Research Assistant, Host: Prof Myles Allen

- Working with the net zero network, focusing on SME decarbonisation in cooperation with the International Chamber of Commerce, Chapter Zero, We Mean Business, and others. Supervised by Prof Myles Allen.

Whiteson Research Lab [Oxford] (Jun 2017 - today)
Visiting Postgraduate Student, Host: Prof Shimon Whiteson

- Working closely with WhiRL on a variety of cooperative deep multi-agent reinforcement learning problems.

Max Planck Institute for Brain Science [Frankfurt, DE] (Nov 2014 - Dec 2014)
Research Intern, Host: Prof Gilles Laurent

- Developed, implemented, and tested computer vision algorithms for behavioural experiments in turtles using OpenCV and PyQT. Assisted with in-vivo electrophysiology experiments.

Pontificia Universidad Católica de Chile [Santiago de Chile] (Jun 2010 - Jul 2010)
Research Intern, Host: Prof Felipe Barrientos

- 7-week research project in galaxy morphology at the Department of Astrophysics. Design and implementation of large-scale image processing tool in Python.
- Debugging and execution on a 512-core supercomputer. Software prototype for use at the Large Synoptic Survey Telescope.

Machine Learning Research Experience during the PhD

ESA Frontier Development Lab [Oxford] (Jun 2020 - Aug 2020)
Deep Learning Researcher

- Working on mid-term precipitation forecasting with deep learning using reanalysis and satellite data. Supervised by Dr. Duncan Watson-Parris and Dr. Matthew Chantry. Funded by European Space Agency.
- Conceptualised and implemented open-source data-driven weather forecasting benchmark environment RainBench, together with novel data pipeline PyRain.

Google AI [Zurich] (Jul 2019 - Oct 2019)
PhD Research Intern, Host: Dominik Roblek

- Research on self-supervised learning and AutoML.
- Supervised by Prof Marco Tagliasacchi and Dominik Roblek.

Work Experience before the PhD

Man AHL [Oxford/London, Centre of Excellence in Machine Learning] (July 2016 - Oct 2016)
Machine Learning Paid Intern, Host: Dr Anthony Ledford (AHL Chief Scientist)

- Research on Deep Learning, Bayesian modelling and Reinforcement Learning involving financial data.

Humboldt University [Berlin] (Jun 2015 - Sep 2016)
Research Fellow (full-time). Funder: Deutsche Forschungsgemeinschaft (DFG)

- Researching topics in convex optimisation and statistical learning theory as part of a research position. Also engaged in voluntary teaching and tutoring.

MenschDanke GmbH [Berlin] (Mar 2014 - Sep 2014)
Head of Engineering

- Interim management (6 months) of a team of 4 in-house developers and 4 external partners.
- Full-stack development (LAMP, MEAN) and agile project management (Scrum) at Germany's third-largest e-Commerce (deals) venture. Negotiated long-term hardware contracts and supervised live product migrations.

Centrica [Oxford] (Oct 2012 - Feb 2013)
Student Consultant - Renewable Energies

- Student consultancy project on tidal energy, including group presentation in front of senior managers. Program had competitive admission and required participation in an assessment centre.

Supervision and Teaching

- Since Oct 2021: Teaching undergraduate course *CSCI 4550: Artificial Intelligence* for University of Georgia (UGA) at Oxford Program. Weekly tutorial/lecture sessions based on my own course design.
- Successfully (co-)supervised eleven master's students during the DPhil, resulting in several publications (including at NeurIPS), and a *Hoare prize for the best thesis in the MSc in Computer Science 2021 (University of Oxford)*
- Led weekly tutorial group for an introductory machine learning course at Humboldt-University Berlin. **Awarded top mark in student feedback** (2016).
- 2016. Conceptualised and delivered a lecture series on Deep Learning for graduate students at Humboldt-University Berlin (2016).

Equality, Diversity and Inclusion

- Co-supervised a master's student from Eritrea during the DPhil and providing ongoing personal and academic mentorship for a young female AI researcher from Nigeria since 2019. Acquainted with both through Deep Learning Indaba.

GoVolunteer e.V. [Berlin] (Apr 2016 - Jun 2016)
Head of Partner & Project Management

- Facilitating the work of a nation-wide team of over 20 refugee aid coordinators.

Political Engagement

Oxford Climate Policy Forum [Oxfordshire] (Mar 2014 - Sep 2014)
Ideator and Co-Founder. Endorsed by Caroline Lucas, MP.

- **Oxford Climate Policy Forum (oxcpf.org)** is a unique cross-party initiative of young politicians in Oxfordshire. Endorsed by Caroline Lucas, MP.

UK House of Commons Parliamentary party [Youth branch] (2020)
30 Under 30 Leadership Program.

- Selected as one of the most promising youth politicians by a UK House of Commons Parliamentary party with a strong focus on social and environmental issues.
- Nominated 2020 city council candidate for Holywell, Oxford. Resigned due to Brexit.

UNFCCC COP 23/24 [Bonn/Katowice] (2017/2018)
NGO observer. Host: An accredited environmental NGO.

- Interviewed one of President Putin's scientific climate advisors on economic sanctions and ARAMCO officials on CCuS technology. Successfully brokered a CCuS workshop participation for Prof Myles Allen in Riad, Saudi Arabia.

Public Outreach and Science Communication

- Co-host of SME decarbonisation workshop at Climate Transformation Summit 2021 (jointly with Jacqueline Albers, International Chamber of Commerce)
- Frequent public speaker and panel member, including at Fridays for Future (Oxford, 2019).
- Frequent moderator of public panel discussions, including at ICLR 2021 (with Stuart Russell, Meredith Whittaker, Mary Wareham), and politics (including with Hesse's minister of the environment, Priska Hinz).
- Co-authored commissioned report "Artificial Intelligence & Climate Change: Supplementary Impact Report" for the Oxford Foundry Impact Challenge.
- Published article "Climate Change: The Case For Artificial Intelligence" in The Oxford Student

Skills and Interests

- Languages: German (native), English (fluent), Spanish (advanced), French (intermediate), Mandarin (basic, HSK II), Latin (basic)
- Interests: Technology, Entrepreneurship, Music (Classical Piano, Opera Singing), Politics.