Alec Edwards | MEng

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Education

DPhil in Computer Science

University of Oxford *2019-Present*

• DPhil supervised with Alessandro Abate in conjunction with CDT in Autonomous Intelligent Machines and Systems (AIMS)
• Confirmation of status: December 2022, on track to finish December 2023
• Thesis title: *Formal Verification of Dynamical Models using Neural Networks*
• Broader research interests lie at the intersection of machine learning and formal verification, and how each field can allow the other to construct better, more trustworthy models

MEng in Engineering Science (First Class)

University of Oxford *2014–2018*

• Awarded scholarships following 1^{st} and 2^{nd} year exams
• Specialised in Control and Information Engineering: options including Machine Learning, Nonlinear and Networked Control, Vision and Robotics, Mathematical Techniques
• Completed a 4^{th} year project on Distributed Energy Management in Building Networks; a conference paper based on the work appeared in UKACC 2018
• Awarded the BP Prize for best Chemical Engineering 3^{rd} Year Project

Solihull Sixth Form College

A-Levels *2012–2014*

• A*s in Maths, Chemistry, Physics and Further Maths, A in AS Biology

The Coleshill School

Secondary School *2007–2012*

• 9A*s and 1A at GCSE (including A*s in Maths, English Lang, English Lit, Triple Science), A in AS English Lit

Academic Experience

Teaching/ Supervision

AIMS CDT Systems Verification Course

University of Oxford *2022-2023*

• Conceived, designed and taught a lab course *An Introduction to SMT-Solving* for AIMS CDT (and external) students
• The course encourages ML-familiar students to interact with logic common in formal verification using SMT-solving
• Taught in Python using Z3, example tasks involve building a Sudoku solver and synthesising a Lyapunov function using CEGIS
• Received positive and constructive feedback from students both years, allowing improvements for successive years

Supervision of MSc Student

University of Oxford *2022*

• Supervised a CS MSc student on a project involving the use of SMT-solving to quantify the probability a probabilistic program is safe
• The student achieved a high grade and the work culminated in a paper at CONCUR 2023

Publications

Alec Edwards, Mirco Giacobbe, and Alessandro Abate. On the trade-off between efficiency and precision of neural abstractions. In *QEST*, 2023.

Alessandro Abate, Alec Edwards, Mirco Giacobbe, Hashan Punchihewa, and Diptarko Roy. Quantitative verification with neural networks. In *CONCUR*, 2023.

Alessandro Abate, Alec Edwards, and Mirco Giacobbe. Neural abstractions. In *Thirty-Sixth Conference on Neural Information Processing Systems*, 2022.

Alessandro Abate, Daniele Ahmed, Alec Edwards, Mirco Giacobbe, and Andrea Peruffo. FOSSIL: A software tool for the formal synthesis of lyapunov functions and barrier certificates using neural networks. In *Proceedings of the 24th*

International Conference on Hybrid Systems: Computation and Control, HSCC '21, pages 1–11, New York, NY, USA, May 2021. Association for Computing Machinery.

Alec Edwards, Jan-Peter Calliess, and Kostas Margellos. Distributed optimisation for energy management in building networks. In *2018 UKACC 12th International Conference on Control (CONTROL)*, pages 44–49, 2018.

Submitted Works

Alessandro Abate, Sergiy Bogomolov, Alec Edwards, Kostiantyn Potomkin, Sadegh Soudjani and Paolo Zuliani. Safe Reach Set Computation via Neural Barrier Certificates.

Virginie Debauche, Alec Edwards, Raphael Jungers and Alessandro Abate. Stability Analysis of Switched Linear Systems with Neural Lyapunov Functions, submitted to AAAI 2023.

Relevant Exprience

Research Assisstant

Energy Futures Lab, Imperial College London *December 2018–August 2019*

• Conducted a scoping project on the potential for light electric vehicles in Sub-Saharan Africa, funded by the Global Challenges Research Fund

• Research to gain both technical and social insight into the corresponding challenges and opportunities, including those relating to transport usage, charging possibilities and business case feasibility

• Worked closely with Research Management teams to organise workshops with local stakeholders and researchers

Miscellaneous

High Performance Server Administrator

OxCAV *2020–Present*

• Administer the Oxford Computer Aided Verification (OxCAV) server

• Implemented custom Bash and Docker-based login system allowing users local control over installation and running of programs without access to host root

• Maintain and update the server, provide assistance to users and IT in case of issues

JCR Computing Rep

Worcester College *April 2015–April 2016*

• Acted as first port of call for student IT issues

• Contributed to Computing Committee meetings with IT-stakeholders across college on behalf of JCR

• Co-operated with the JCR Committee on resolving college-wide issues and organising events

Skills

• Advanced exprience with Python and machine learning packages including: PyTorch, Jax

• Advanced user of SMT-solving tools, including Marabou (ReluPlex), DNNV, DReal and Z3

• Intermediate experience with C