

Dominik Wagner

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Research Interests

- Probabilistic programming
- Formal verification and principles of programming languages
- Statistical machine learning (especially Bayesian inference, reinforcement learning and (gradient-based) optimisation)

Research and Development Experience

Research Fellow

Oct 2023 – present

Nanyang Technological University (NTU), Singapore

- TODO

Applied Scientist Intern

Jul – Oct 2020

Amazon Web Services (Automated Reasoning Group), Portland, OR (remote)

- Gained experience in cloud computing and AWS, especially Identity and Access Management
- Proved functional correctness of prototypical, security-critical code using the verification-aware programming language Dafny (> 3300 lines of verified code)

Student Assistant

Nov 2014 – Sep 2017

Max Planck Institute for Informatics, Saarbrücken

- Development of a modern CDCL-based SAT-solver used in the ground linear arithmetic solver SPASS-SATT, which won the tracks “QF_LIA” and “Best Newcomer” in the SMT Competition 2018
- Experience in writing highly efficient C-code using debugging/profiling tools like gdb, valgrind, gprof, etc.
- Supervisor: Prof. Christoph Weidenbach

Education

DPhil (PhD) in Computer Science

Oct 2018 – Feb 2024

University of Oxford, Oriel College and Magdalen College, Oxford

- Thesis: “**Fast and Correct Variational Inference for Probabilistic Programming: Differentiability, Reparameterisation and Smoothing**”
Supervisor: Prof. Luke Ong

MSc in Mathematics and Foundations of Computer Science

Oct 2017 – Sep 2018

University of Oxford, Magdalen College, Oxford, with Distinction

- Thesis: “**Resolution for Higher-Order Constrained Horn Clauses**”
Supervisor: Prof. Luke Ong

Preparatory phase of the Saarbrücken Graduate School of Computer Science

May – Sep 2017

Saarland University, Saarbrücken

BSc in Computer Science (minor: Mathematics)

Apr 2014 – Apr 2017

Saarland University, Saarbrücken, Grade: 1.0 (best on a scale from 1.0 to 5.0)

FdSI Bachelor Award for best overall performance (up to 3 recipients/semester)

Publications

Xuan-Bach Le*, **Dominik Wagner***, Leon Witzman, Alexander Rabinovich, Luke Ong. Reinforcement Learning with LTL and ω -Regular Objectives via Optimality-Preserving Translation to Average Rewards. In *38th Annual Conference on Neural Information Processing Systems (NeurIPS)*, 2024 (to appear).

Dominik Wagner*, Basim Khajwal, C.-H. Luke Ong. Diagonalisation SGD: Fast & Convergent SGD for Non-Differentiable Models via Reparameterisation and Smoothing. In *27th International Conference on Artificial Intelligence and Statistics (AISTATS)*, 2024.

Basim Khajwal, C.-H. Luke Ong, **Dominik Wagner***. Fast and Correct Gradient-Based Optimisation for Probabilistic Programming via Smoothing. In *32th European Symposium on Programming (ESOP)*, 2023.

Carol Mak*, C.-H. Luke Ong, Hugo Paquet*, **Dominik Wagner***. Densities of Almost Surely Terminating Probabilistic Programs are Differentiable Almost Everywhere. In *30th European Symposium on Programming (ESOP)*, 2021.

Toby Cathcart Burn*, Luke Ong, Steven Ramsay, **Dominik Wagner**. Initial Limit Datalog: a New Extensible Class of Decidable Constrained Horn Clauses. In *36th Annual ACM/IEEE Symposium on Logic in Computer Science (LICS)*, 2021.

C.-H. Luke Ong and **Dominik Wagner***. HoCHC: A refutationally complete and semantically invariant system of higher-order logic modulo theories. In *34th Annual ACM/IEEE Symposium on Logic in Computer Science, (LICS), Vancouver, BC, Canada, June 24-27, 2019*, 2019.

* marks lead author(s)

Programming Skills

Imperative languages: Python and jax (used for benchmarking proposed inference algorithms)
Java, C (used in the implementation of a modern SAT solver)

Functional languages: Haskell, OCaml, SML

Interactive theorem provers: Coq

Program verifiers: Dafny (used in the internship with Amazon Web Services)

Tools: git, gdb, valgrind, etc.

Awards and Funding (selection)

FdSI Bachelor Award 2017

Best overall performance in the BSc programme of Saarland University (up to 3 recipients/semester)

Scholarship holder of the German Academic Scholarship Foundation 2015 – 2018

Financial and academic support (e.g. summer academies) of less than 0.5% of German students

Teaching Experience

Graduate Teaching and Research Scholar Oct 2020 – Sep 2023

Oriel College, Oxford

- o Individualised teaching of undergraduates in very small groups (one to three students)
- o Assisted undergraduate admission interviews
- o Courses: Probability, Continuous Mathematics, Imperative Programming, Models of Computation