Tobias Schröder

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Summary

I am a doctoral researcher focused on generative modelling for statistical inference. I draw on an interdisciplinary background in mathematics, physics, and optimisation, and was inspired to pursue a PhD by the applications of optimal transport to machine learning. Currently, I develop training algorithms for multi-modal energy-based models to target challenging inverse problems in engineering, physics, and biology.

Experience

Microsoft Research New England, Cambridge MA - *PhD Research Intern* Jun 2024 – Sep 2024

Manager: Lester Mackey

Developed algorithms for efficient approximate softmax attention for long context windows using PyTorch. Proved theoretical guarantees for the quality of the approximation. Conducted numerical experiments with transformer-based language and image models.

Education

PhD in Mathematics – *Imperial College London, United Kingdom* Oct 2021 – Nov 2025

Supervisor: Andrew B. Duncan and Greg Pavliotis
Research Area: *Probabilistic Generative Models for Statistical Inference*

MSc in Mathematics – *Heidelberg University, Germany* Jul 2019 – Jul 2021

Grade: 1,0 (equivalent GPA: 4.0/4.0, top 5% of cohort)
Thesis (Supervision: Christoph Schnörr): *Kernelized Stein Discrepancies for Variational Inference*

Exchange year – *University of Washington, WA* Sep 2019 – Jun 2020

GPA: 4.0/4.0
Funding: Fulbright scholarship, Baden-Württemberg scholarship
Reading on Optimal Transport and Information Geometry

BSc in Mathematics – *Heidelberg University, Germany* Jul 2017 – Jul 2019

Grade: 1,2 (equivalent GPA: 3.8/4.0, top 5% of cohort)
Thesis (Supervision: Anna Wienhard): *Scaling Limits of Random Trees*

BSc in Physics – *Heidelberg University, Germany* Oct 2015 – Feb 2019

Grade: 1,3 (equivalent GPA > 3.7/4.0, top 10% of cohort)
Thesis (Supervision: Thomas Gasenzer): *Effective Theory of Goldstone Bosons in an N-component Gross-Pitaevskii model*

Publications

P. Cordero-Encinar, **T. Schröder,** P. Yatsyshin, A. Duncan. *Deep Optimal Sensor Placement for Black Box Stochastic Simulations* (AISTATS 2025)

T. Schröder, Z Ou, Y. Li, A. Duncan. *Energy-Based Modelling for Discrete and Mixed Data via Heat Equations on Structured Spaces* (NeurIPS 2024)

T. Schröder, Z. Ou, J. Lim, Y. Li, S. Vollmer, A. Duncan. *Energy Discrepancies: A Score-Independent Loss for Energy-Based Models.* (NeurIPS 2023)

Technical Skills

- **Machine Learning**: Probabilistic generative models, energy-based models, diffusion models (discrete and continuous), flow-based models, MCMC methods, inverse problems, Bayesian inference, simulation-based inference, experimental design, supervised learning
- **Programming**: Python, PyTorch, JAX, Transformers, Git, Object-Oriented Programming
- **Mathematics & Statistics**: Partial differential equations, stochastic processes, probability theory, differential geometry, optimal transport, information geometry, statistical learning, Bayesian statistics, statistical physics

Community involvement

- **Organiser** of the *Junior Statistics Seminar* at Imperial College London (2022 - 2024): creating a space for PhD students to encourage collaboration and exchange ideas.
- **Conference Reviewer:** NeurIPS 2024, ICML 2024 & 2025, ICLR 2025
- **Tutoring:** Assisted in supervision of a first year PhD student: Developed feasible research ideas, conducted the literature review, provided feedback and research advice in weekly progress meetings, helped writing a conference paper (Oct 2023 – now)**;** Teaching Assistant for *Probability for Statistics* at Imperial College London
- **Orchestra:** Member (Violin) of the *Imperial College Sinfonietta* (Oct 2021 – Oct 2023).

Languages

- **Languages**: German (Native), English (Fluent)