Tobias Schröder

t.schroeder21@imperial.ac.uk |. linkedin.com/in/tobias-schroeder-ml | tobias-schroeder.github.io

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 solve 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. Proved theoretical guarantees for the quality of the approximation. Implemented parallelisable approximation algorithms using PyTorch. Conducted numerical experiments on language and image models.

Education

PhD in Mathematics – *Imperial College London, United Kingdom* Oct 2021 – Oct 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)
Master's thesis: *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)

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

Grade: 1,3 (equivalent GPA > 3.7/4.0, top 10% of cohort)

Publications

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

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

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 matching, MCMC methods, inverse problems, inverse reinforcement learning; Bayesian inference, supervised learning
- **Programming**: Python, PyTorch, JAX, 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 - now): creating a space for PhD students to encourage collaboration and exchange ideas.
- **Conference Reviewer:** NeurIPS, ICML, ICLR
- **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 - now).

Languages

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