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# Sebastian Schmon, DPhil (Oxford)

Research Scientist

<https://schmons.github.io>

**I** like ideas — I like to come up with algorithms and strategies, but I also like to learn from others and discuss concepts and thoughts. During my research career, I have published at leading machine learning conferences such as **Neurips**, **ICML**, and **AISTATS**, as well as highly regarded statistical publications such as *Biometrika*. My unpublished research formed the basis of new product offerings or significant enhancements. Now I am looking for an opportunity to have immediate real-world impact.

## ⚙ Experience

2023 — today

**Research Scientist** Shift Lab Ltd., London, United Kingdom

*Founded by ex-Deepmind people the aim of Shift Lab is bridging the gap between academic AI research and real-world production software. As part of my position there I have been working with state-of-the-art generative models such as OpenAI's language models as well as diffusion models for image generation. My first project included a variety of statistics / ML approaches to learn representations from language model embeddings and combine them with expert opinions on the "tone of voice" of brands' communications. Based on those representations we managed to build a model to maximise the value of brands' communication in terms of user engagement based on actionable attributes. I am proud that we managed to get this prototype ready 3 weeks after my joining.*

2021 — 2022

**Assistant Professor in Statistics** Department of Mathematics  
University of Durham, Durham, United Kingdom

*The responsibilities of a professor include supervision / pastoral care of undergraduate and graduate students. As such I have (and still am) supervising PhD, MSc and BSc students on modern statistical and machine learning methods (e.g. diffusion models, Hamiltonian Monte Carlo). I am delighted to say that some student projects have led to papers that were accepted at CVPR and ICLR workshops. As part of my teaching duties I have updated the universities "unsupervised learning" module to now include neural network based approaches (e.g. autoencoders / variational autoencoders) which were previously completely absent. In other engagements, I was part of a committee to set up a new doctoral training centre and serve as a connection to businesses.*

2020 — 2022	<p><b>Research Scientist</b> Improbable Worlds Ltd., London, United Kingdom</p> <p><i>Improbable Defence (part of Improbable Worlds) leverages new technologies for large scale networked simulations to build generative models of complex systems and digital twins. Such synthetic environments can be used to test interventions and policies where it cannot be tested in real environments (e.g. Covid-19 policies, cyberattacks). As part of the research team, our task was to solve the most challenging problems the company faced. My work resolved around 1) making those synthetic environments as realistic as possible and to estimate the uncertainty associated with imperfect simulations and 2) building fast surrogate models that could reduce the model complexity without losing much of the predictive accuracy. An important part of my research philosophy is that research progress made it into production which is why I designed a dedicated <b>python</b> module with an easy-to-use API. This enabled the use of my software without detailed understanding of the underlying theory. Tools I used: agent-based models, probabilistic models, (deep) surrogate models such as neural ODEs, normalising flows, (deep) Bayesian inference, diffusion models and generalised Bayesian inference.</i></p>
2018 — 2020	<p><b>Head of Data Science</b> Foresight Works, technology start-up, Oxford, United Kingdom</p> <p><i>Foresight Works is about bringing megaprojects to the digital age and use data as well as AI to avoid large (and otherwise common) cost overruns and improve executive decision making. As one of the first employees I helped the company set up and brainstorm their core products, including appropriate metrics and statistical forecasting techniques to ensure adequate project progress as well as data driven estimates of potential cost overruns. This includes the setting up of a data pipeline and databases. To kickstart and validate the value proposition we consulted with clients (large international companies, &gt;£5bn in revenue) on data science and analytics challenges. I personally compiled and delivered the final project report that was presented to the COO, providing recommendations on financial decisions for a new £1.2bn megaproject).</i></p>

## Education

2015 — 2020	<p><b>PhD Statistics</b> Magdalen College, University of Oxford, United Kingdom</p> <p>Computational Statistics and Machine Learning</p> <p>Supervisors: Arnaud Doucet (<a href="http://www.stats.ox.ac.uk/~doucet">http://www.stats.ox.ac.uk/~doucet</a>), George Deligiannidis (<a href="http://www.stats.ox.ac.uk/~deligian">http://www.stats.ox.ac.uk/~deligian</a>)</p>
2014 — 2015	<p><b>Mathematics</b> Imperial College London, United Kingdom</p> <p>(Erasmus Programme, non-degree)</p>
2013 — 2016	<p><b>MSc Statistics</b> Humboldt University of Berlin, Germany</p> <p>Concentrations in Statistical Modelling and Inference, Econometrics, Monte-Carlo Methods and Stochastic Simulation, Survey Methodology</p> <p><i>With Distinction</i></p>

2012 — 2015

**BSc Mathematics** Free University of Berlin, Germany  
Concentrations in Probability Theory, Numerical Methods and Functional Analysis  
Minor in Statistics

2009 — 2013

**BSc Economics** Free University of Berlin, Germany  
Concentrations in Quantitative Methods (Econometrics, Time Series and Statistics) and Economic Theory

## </> Programming

I write my prototypes mostly in **Python** or R. For short statistical analyses I rely on R, whereas I use Python for longer scripts or projects. My favourite deep learning module is **pytorch**. In addition, I always had a passion for making my own  $\text{\LaTeX}$  templates / functions etc.

## Selected Publications

*A selection of recent publications that I am particularly proud of. (Ask me why! 😊)*

**Robust Neural Posterior Estimation and Statistical Model Criticism**  
with Daniel Ward, Patrick Cannon, Mark Beaumont and Matteo Fasiolo  
NeuRIPS 2022

**Learning Multimodal VAEs through Mutual Supervision**  
with Tom Joy, Yuge Shi, Philip H.S. Torr, Tom Rainforth, and N. Siddharth  
ICLR 2022 (Spotlight)

**Amortised Likelihood-free Inference for Expensive Time-series Simulators with Signed Ratio Estimation**  
with Joel Dyer and Patrick Cannon  
AISTATS 2022

**Optimal scaling of random walk Metropolis algorithms using Bayesian large-sample asymptotics**  
with Philippe Gagnon  
Statistics and Computing, 2022

**Chapturing Label Characteristics in VAEs**  
with Tom Joy, Philipp Torr, Siddharth Narayanaswamy and Tom Rainforth  
ICLR 2021

**Large Sample Asymptotics of the Pseudo-Marginal Method**  
with Arnaud Doucet, George Deligiannidis and Mike Pitt  
Biometrika 2021

## Workshop Paper

### **Denoising diffusion probabilistic models on $SO(3)$ for rotational alignment**

with Adam Leach, Matteo T. Degiacomi and Chris G. Willcocks

Workshop on Geometrical and Topological Representation Learning, ICLR 2022

### **AnoDDPM: Anomaly Detection with Denoising Diffusion Probabilistic Models using Simplex Noise**

with Julian Wyatt, Adam Leach and Chris G. Willcocks

NTIRE, CVPR 2022

### **Calibrating Agent-based Models to Microdata with Graph Neural Networks**

with Joel Dyer and Patrick Cannon

AI4ABM Workshop, ICML 2022 (Best Paper Award)

## Unpublished

### **Neural ODEs for Multi-state Survival Analysis**

with Stefan Groha and Alexander Gusev

[arxiv.org/abs/2006.04893](https://arxiv.org/abs/2006.04893)

### **Investigating the Impact of Model Misspecification in Neural Simulation-based Inference**

with Patrick Cannon and Daniel Ward

<https://arxiv.org/abs/2209.01845>

## Awards

- EPSRC DPhil scholarship
- Departmental teaching scholarship, Oxford, Department of Statistics
- Humboldt University Erasmus grant for an exchange year at Imperial College
- Magdalen College Oxford travel/research grant
- ISBA travel grant