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Dr Patrick Cannon

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PROFILE

Experienced researcher and engineer working on machine learning and AI. Educational background in mathematics, computational statistics, and machine learning. Recent publications at NeurIPS, UAI, ICML, AISTATS focusing broadly on robust deep learning.

Six years of industry experience applying ML to solve complex real-world problems, with a focus on generative modeling, robust deep learning, and approximate Bayesian inference. Delivered projects in large-scale complex systems, natural language processing, computer vision and uncertainty quantification. Comfortable working across entire project life cycle, from research and prototyping to end-to-end software engineering.

EXPERIENCE

Hadean Generative AI Lead   2024 – present

- Tech lead for AI function, reporting to CTO. Responsible for integration of generative AI methods, principally LLMs, into product suite.
- End-to-end remit spanning problem formulation, model development, software engineering, deployment and internal/external collaboration.
- Design and implementation of LLM agents and LLM software interfaces using a range of strategies like fine-tuning, chain of thought, RAG, ReAct etc.

Themes: LLMs, natural language interfaces, LLM agents, multi-agent systems.

Techwerk Co-Founder   2023 – 2024

- Won and executed ~£300k of AI research contracts. Accepted into funded startup incubator.
- Leading science and engineering function. Established academic partnership with UCL – co-supervising two master's projects investigating neural radiance field (NeRF) algorithms with uncertainty quantification.

Themes: NeRFs, Gaussian Splatting, SLAM, remote sensing, sensor fusion.

Improbable Research Scientist   2019 – 2022

- Delivered high quality ML research to answer technical and scientific product challenges. Defined own research objectives and managed dependencies. Promoted October 2021.
- Designed and lead research agenda with papers accepted at NeurIPS, UAI, AISTATS and ICML.
- Lead research collaborations with several universities. Co-supervised two PhD students (Oxford and Bristol) across topics in variational inference and approximate inference for agent-based models.
- Delivered project centred around uses of LLMs in and for agent-based simulators, using prompt-engineering and fine-tuning strategies, chiefly through OpenAI's API.

Themes: Normalising flows, generative deep learning, uncertainty quantification, agent-based models.

Faculty Data Science Fellow   2018

- Selective programme providing training in technical and commercial aspects of data science.
- Undertook consulting project for a leading UK fintech startup. Implemented solution put into production.

EDUCATION

University of Bristol PhD Statistics   2014 – 2018

- Research in novel Monte Carlo techniques, particularly particle Markov chain Monte Carlo, applied to coalescent models in population genetics. Coded in R and C++.
- Advised by Profs. Christophe Andrieu and Mark Beaumont.
- Main research themes: computational statistics, sequential Monte Carlo, Markov chain Monte Carlo.

University of Oxford MSc Mathematical and Computational Finance   2013 – 2014

- Distinction awarded for dissertation on sequential Monte Carlo methodology for rare events.
- Courses included stochastic calculus, numerical methods, option pricing and Bayesian networks.

University of Bristol BSc Mathematics (First Class)   2010 – 2013

SKILLS

Engineering	Python (NumPy, PyTorch), Javascript, R, Linux, Docker, Git
Business	Technical proposal and grant writing, research/engineering management, communicating technical material to decision makers, PhD supervision, mentoring

RESEARCH INTERESTS

Research topics	Generative modelling (e.g. normalising flows), approximate Bayesian inference, generalised Bayes, robust inference under misspecification, agent-based modelling
Wider interests	Large language models (LLMs), robust deep learning, uncertainty quantification, AI alignment, black-box optimisation

SELECTED PUBLICATIONS & PREPRINTS

Approximate Bayesian Computation with Path Signatures
Joel Dyer, **Patrick Cannon**, Sebastian Schmon
*UAI (The Conference on Uncertainty in Artificial Intelligence), 2024 (**spotlight**)*

Robust Neural Posterior Estimation and Statistical Model Criticism
Daniel Ward, **Patrick Cannon**, Mark Beaumont, Matteo Fasiolo, Sebastian Schmon
NeurIPS, 2022

Investigating the Impact of Model Misspecification in Simulation-Based Inference
Patrick Cannon, Daniel Ward, Sebastian Schmon
arXiv preprint, 2022

Amortised Inference for Expensive Time-Series Simulators with Signatured Ratio Estimation
Joel Dyer, **Patrick Cannon**, Sebastian Schmon
AISTATS, 2022

Calibrating Agent-Based Models to Microdata with Graph Neural Networks
Joel Dyer, **Patrick Cannon**, J. Doyne Farmer, Sebastian Schmon
*ICML, AI4ABM Workshop, 2022 (**spotlight**)*

High Performance Simulation for Scalable Multi-Agent Reinforcement Learning

Jordan Langham-Lopez, **Patrick Cannon**, Sebastian Schmon

*ICML, AI4ABM Workshop, 2022 (**spotlight**)*

Generalized Posteriors in Approximate Bayesian Computation

Sebastian Schmon*, **Patrick Cannon***, Jeremias Knoblauch

AABI (Symposium on Advances in Approximate Bayesian Inference), 2021

Deep Signature Statistics for Likelihood-free Time-series Models

Joel Dyer, **Patrick Cannon**, Sebastian Schmon

ICML, Workshop on Invertible Neural Networks, Normalizing Flows, and Explicit Likelihood Models, 2021

A Particle Markov Chain Monte Carlo Approach to Coalescent Inference

Patrick Cannon

PhD Dissertation, University of Bristol, 2019