CONOR HASSAN

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EDUCATION

Doctor of Philosophy (PhD) in Statistics, Queensland University of Technology (QUT) Expected Apr. 2024

- Topic: Bayesian federated learning and deep generative modelling for inference of private, dependent data.
- Research area: *Computational statistics, Bayesian inference, probabilistic machine learning, differential privacy, federated learning.*

Bachelor of Science with Honours, First Class in Statistics, University of Otago Feb. 2020 – Nov. 2020
Bachelor of Science in Statistics, minor in Mathematics, University of Otago Feb. 2017 – Nov. 2019

- Awarded the *top graduating Honours* student across the Faculty of Science.
- Recipient of the *Prime Minister's Scholarship for Asia*; fully funded academic exchange at National University of Singapore (NUS).

EXPERIENCE

PhD Researcher Apr. 2021 – Present
QUT *Brisbane, Australia*

- Developing methodology for federated learning of complex hierarchical Bayesian models.
- Research areas include Bayesian computation, variational inference, deep generative modelling, and Gaussian processes, requiring advanced use of Python and deep learning and probabilistic programming libraries.
- Liaise with international cancer registries to model cancer diagnosis and survival rates using federated learning.

Research Data Scientist Nov. 2022 – Apr. 2023
WearOptimo *Brisbane, Australia*

- Contributed to the development of real-time biological signal detection in microwearable devices.
- Developed an inference pipeline for complex biophysical models using *Pyro*, *NumPyro*, *PyTorch* and *JAX*.
- Responsibilities include developing models, inference algorithms, model selection tools, visualizations, data cleaning, and ensuring effective presentation of results to mechanical, medical, and electrical engineers, chemists, and biologists.

Statistical Scientist Intern Nov. 2020 – Feb. 2021
AgResearch *Palmerston North, New Zealand*

- Implemented hierarchical Bayesian models to estimate drug resistance for faecal egg count reduction using *Stan* and *brms*, by extending the existing, poorly calibrated models in the literature.

Quantitative Trader Intern Nov. 2019 – Feb. 2020
IMC Financial Markets *Sydney, Australia*

- Worked within the Hong Kong Delta 1 team, analyzed market data, developed trading strategies, and predicted missing counterparties.

Risk Advisory Consultant Intern Nov. 2018 – Feb. 2019
Ernst & Young *Christchurch, New Zealand*

- Analyzed historic payroll data to build financial models and risk assessments for clients.

Teaching and Research Assistant roles Jul. 2018 – Apr. 2022
QUT, University of Otago *Multiple locations*

- Tutored for seven mathematics and statistics courses, ranging from first-year to master's level, and received perfect feedback scores.
- Developed novel methodology and software to generate synthetic medical and health-related data using deep generative models such as *normalizing flows*, *GANs*, and *VAEs*, and differential privacy methods.

PUBLICATIONS

Conor Hassan, Robert Salomone, and Kerrie Mengersen."Federated Variational Inference Methods for Structured Latent Variable Models" arXiv preprint arXiv:2302.03314 (2023). Under review.

Conor Hassan, Robert Salomone, and Kerrie Mengersen. "Deep Generative Models, Synthetic Tabular Data, and Differential Privacy: An Overview and Synthesis" arXiv preprint arXiv:2307.15424 (2023).

Conor Hassan, et al. "Deep Generative Priors for Dependent Data Federated Learning." In preparation.

Conor Hassan, et al. "Bayesian Vertical Federated Learning via Data Augmentation." In preparation.

Joshua J. Bon, et al. "Being Bayesian in the 2020s: opportunities and challenges in the practice of modern applied Bayesian statistics." Philosophical Transactions of the Royal Society A (2023). Accepted for publication.

PROJECTS

Google Summer of Code (GSoC) Contributor with PyMC. Contribution of *multivariate distributions* used as building blocks for spatial and spatiotemporal modelling of data. Applications of these models commonly include *disease mapping* and *missing data imputation*.

Federated Variational Inference for Structured Latent Variable Models. Development of two methodologically novel algorithms for embarrassingly parallel inference of hierarchical models. Corresponding software implementation that is generic to different model classes, and only requires users to input a model function using libraries such as *NumPyro* or *Tensorflow Probability*.

TECHNICAL SKILLS

- Advanced **Python** knowledge, inclusive of automatic differentiation and deep learning libraries *PyTorch* and *JAX*, and probabilistic programming libraries *Pyro, NumPyro, Tensorflow Probability*, and *PyMC*.
- Proficient in **R**, including libraries such as *Stan, brms*, and *JAGS*.
- Working knowledge of **Java** and **Julia**. Basic knowledge of **C++**.

AWARDS

- *Australian Research Council Linkage Scholarship*, valued at $\$36,000$ per annum for 3.5 years (**2021**).
- *Otago Institute Prize*, top graduating Honours student across the Faculty of Science (**2021**).
- *University of Otago Gopi Jain Memorial Prize*, highest achieving Statistics Honours student (**2020**).
- *University of Otago Beverly Bursary*, highest achieving student in examinations (**2019**, **2020**).
- *Prime Minister's Scholarship for Asia*, academic exchange at NUS funded by the NZ Government (**2019**).
- *University of Otago Staff Prize in Mathematics & Statistics*, excellent examination results (**2017**, **2018**).
- Recipient of six entrance scholarships, covering university fees and living costs for four years (**2017–2020**).

EXTRA-CURRICULAR ACTIVITIES

- **Presentations:** Invited talks at European Meeting of Statisticians Conference (Warsaw, Poland; July 2023), Owkin (Paris, France; July 2023), IKNL (Eindhoven, Netherlands; June 2023), Australian Data Science Network (ADSN) Workshop on Synthetic Data (online; September 2021), Australian Mathematical Sciences Institute (AMSI) Winter School on Statistical Data Science (Brisbane, Australia; July 2021), University of Otago Honours Student Symposium (Dunedin, New Zealand, November 2020). Invited posters at CIRM Workshop on Approximate Bayesian Inference (Luminy, France; June 2023), Conference for the International Society of Bayesian Analysis (ISBA) (Montreal, Canada; June 2022)
- **Leadership:** Initiator and lead organizer of a **probabilistic machine learning** reading group, covering advanced topics such as directed and undirected graphical models, variational inference, Gaussian processes, energy-based models and normalizing flows. Committee member for the inaugural **Australian Data Science Network (ADSN) Conference** (November 2022). Committee member for the **Australian Centre of Excellence in Mathematics & Statistics (ACEMS) Early Career Researcher and Student Conference** (November 2021). Head instructor at an English language summer camp in Xi'an, China (June–July 2019).