Sam Bowyer

sambowyer2@gmail.com | sambowyer.com in sam-bowyer | ♥ sambowyer | × sambowyer__ 34 Doudney Court, William Street, Bristol, BS3 4AP

Third-year PhD student specializing in probabilistic machine learning and AI. Excited about applying mathematical techniques to a wide range of AI/ML research problems and continuously exploring new areas of mathematics.

EDUCATION

• University of Bristol, COMPASS CDT [6] Sep 2022 - (Sep 2026) PhD student in Computational Statistics & Data Science Bristol • Supervised by Dr Laurence Aitchison working on probabilistic machine learning and AI. • Completed statistics and data science modules in first year of CDT within the Bristol School of Mathematics. • Attended the Academy for PhD Training in Statistics (APTS). [3] • University of Birmingham Sep 2018 - Jun 2022 1st Class MSci Mathematics & Computer Science with Honours (Overall 84.3%, 4.25 GPA) Birmingham • 1st vear: 93.0%; 2nd vear: 95.4%; 3rd vear: 81.7%; 4th vear: 84.7%. • Awarded Computer Science School Undergraduate Prize, 2018/2019 for highest 1st year grade on course. • Took a broad range of courses in both Maths and CS departments, eventually specialising in machine learning. • Achieved mark of 82% for final year Masters dissertation on reinforcement learning within tournament structures. Cedars Upper School 2013 - 2018 • A Levels: A*A*A*A (Maths, Further Maths, Physics, Music) Leighton Buzzard EMPLOYMENT · School of Mathematics, University of Bristol Jan 2024 - Present Undergraduate Mathematics Tutor and Exam Marker Bristol • Prepared and taught tutorials for Analysis, Mathematical Programming, and Probability & Statistics modules. • Moderated assessment sessions for Perspectives in Data Science and Perspectives in Mathematics modules. • Marked exams for Analysis, Introduction to Pure Mathematics, Linear Algebra, and Probability & Statistics modules. • WM-REDI/City-REDI Aug 2021 - Nov 2021 Policy & Data Analyst Birmingham • Designed and implemented a Python data pipeline to automatically download, cleanse and upload new dataset releases from a variety of sources into WM-REDI's Datalab PostgreSQL database to be used in policy research. • School of Computer Science, University of Birmingham Sep 2019 - Mar 2020 Lab Demonstrator — MSc/ICY Software Workshop Birmingham • Assisted MSc/year-in-CS students Java, SQL, HTML/CSS in programming lab lectures and coursework help sessions. **PhD Projects** • Bayesian Evals: applying Bayesian uncertainty quantification to LLM evals Started Dec 2024 frequentist and Bayesian statistics, error bars, eval comparisons and interpretations [sambowyer/bayes evals [] • Showed poor performance of commonly-used error-bar calculation techniques (based on the Central Limit Theorem) in few-data eval settings, and provided a lightweight library for practitioners to adopt alternative recommendations. • Currently working on extracting LLM interpretability from evals using Bayesian inference techniques. Alan: Massively Parallel Probabilistic Programming Language Started Jan 2023 probabilistic programming, numerical programming, Monte Carlo methods [alan-ppl/alan **()**] • Provides a simple and intuitive way to perform fast and accurate "Massively Parallel" Bayesian inference on general, user-specified probabilistic models optimised for GPU computation. • Learnt how to design and implement complex algorithms in code whilst maintaining simplicity on the user's end. • Led to two papers: autograd-based importance sampling (MPIS); EM algorithm for Approximate Posteriors (QEM). **PUBLICATIONS** S = SPOTLIGHT PAPER[ICML (S)] Position: Don't use the CLT in LLM evals with fewer than a few hundred datapoints. Sam Bowyer, Laurence Aitchison, Desi R. Ivanova (2025). arXiv:2503.01747. [AABI] Massively Parallel Expectation Maximization For Approximate Posteriors. Thomas Heap, Sam Bowyer, Laurence Aitchison (2025). Advances in Approximate Bayesian Inference 2025, PMLR (Upcoming). arXiv:2503.08264.

[UAI] Using Autodiff to Estimate Posterior Moments, Marginals and Samples. Sam Bowyer, Thomas Heap, Laurence Aitchison (2024). Proceedings of the Fortieth Conference on Uncertainty in Artificial Intelligence, PMLR 244:394–417.

SKILLS

Programming Languages

• Primary: Python

\circ **Competent:** C/C++, R, Stan

- Some experience: Haskell, JavaScript, HTML/CSS
- Data Science & Machine Learning Libraries: PyTorch, NumPy, JAX, Pandas, SciPy, Sci-kit-learn, Huggingface (Transformers, Datasets, PEFT, Tokenizers, etc.)
- Probabilistic Programming Languages: Stan, Pyro, PyMC
- Other technologies: Git, SQL, Bash, Linux, Slurm, Weights & Biases

OTHER PROJECTS

• Moracle: Tool for Drug Discovery Practitioners

Team project at Entrepreneur First/Valence Labs Bio x AI Hackathon. • Awarded second place: £3000 in Nebius GPU credits and lunch with EF founder Matt Clifford.

- Web tool for interactive predictions of a molecule's clinical viability using protein-binding affinity and historical clinical trial data.
- Worked in a small five-person team with 30 hour time limit to research, plan, construct and present a proof-of-concept.

Reinforcement Learning for Tournament Structures

- 4th year MSci Project in Mathematical Science
- [sambowyer/tournaments **()**] • Analysed classical tournament structures and modern reinforcement learning (RL) algorithms as inference methods for constructing a ranking between a set of stochastic competitors.

• This work has become increasingly relevant as LLM post-training and evals rely heavily on RL and ranking systems.

• Pitch Detection and Phase Vocoder

- 3rd year MSci Computer Science Project
- Implemented a variety of pitch detection algorithms and a phase vocoder in Python to pitch-shift/pitch-correct audio files.

• Learnt how to understand and convert complex digital signal processing mathematics into efficient code.

OTHER ACTIVITIES

• Reviewing for UAI 2025 Mar 2025 Presentations Sep 2022 - Present Regularly present talks on various topics in machine learning. [sambowyer/presentations [] \circ Talks range from in-depth discussion of one paper (e.g. Kolmogorov-Arnold-Networks (KANs) [\mathcal{O}]) to overviews of whole areas (e.g. Simulation Based Inference (SBI) []]). COMPASS Seminar Organiser Jan 2025 - Present Recently took over organising seminars within the CDT on student projects. COMPASS Student Blog Aug 2024 Bayesian LLM Finetuning [6] • Wrote a PhD student blog on LLM finetuning, in particular Bayesian Low-Rank Adaptors (Laplace LoRA), for the COMPASS website. Tailored to be accessible and useful to readers with varying levels of expertise. Compass Away Day 2024 June 2024 • Helped organise a three-day event for COMPASS CDT students involving a series of talks, team-building activities and a writing retreat. Wrote a blog summarising the event for the COMPASS website. $[\mathcal{O}]$

CONFERENCES AND ACADEMIC EVENTS

• AABI	Apr 2025
• ICLR	Apr 2025
AIUK (Turing Institute)	Mar 2025
• UAI	Jul 2024
• AABI	Jul 2024
Turing CDT Conference	Nov 2023
• APTS	Dec 2022 - Aug 2023

INTERESTS

I'm a keen runner (currently training for my first marathon), a rock climbing enthusiast, and regularly play badminton with colleagues. Having played guitar for 15 years in a variety of bands at gigs and festivals around the UK, I'm passionate about music and frequently perform at jazz and funk jam sessions in Bristol.

Oct 2020 - May 2021

[sambowyer/pitchcontrol []

Nov 2024 [luka-kovacevic/moracle **[**]

Oct 2021 - May 2022