Sam Bowyer

✉ sambowyer2@gmail.com | 🌐 sambowyer.com | 🔗 sam-bowyer | 🐙 sambowyer | 𝕏 sambowyer__

Fourth-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 [🔗]**   *Sep 2022 - (Sep 2026)*
  PhD student in Computational Statistics & Data Science   Bristol
  - Supervised by Dr Laurence Aitchison and Dr Mengyue Yang working on probabilistic machine learning and AI.
  - Completed statistics and data science modules in first year of CDT within the Bristol School of Mathematics.

- **University of Birmingham**   *Sep 2018 - Jun 2022*
  1st Class MSci Mathematics & Computer Science with Honours (Overall 84.3%, 4.25 GPA)   Birmingham
  - 1st year: 93.0%; 2nd year: 95.4%; 3rd year: 81.7%; 4th year: 84.7%.
  - Took a broad range of courses in both Maths and CS departments, eventually specialising in machine learning. Fourth year Masters dissertation on reinforcement learning within tournament structures obtained mark of 82%.

- **Cedars Upper School**   *2013 - 2018*
  - A Levels: A*A*A*A (Maths, Further Maths, Physics, Music)   Leighton Buzzard

EMPLOYMENT

- **We Solve Problems [🔗]**   *Sep 2025 - Present*
  Head Tutor for Maths Cirlces and Maths Battles   Bristol
  - Lead problem-solving sessions on Saturdays for 11-16 year olds on behalf of mathematics charity We Solve Problems.

- **School of Mathematics, University of Bristol**   *Jan 2023 - 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.

MAIN PhD PROJECTS

- **Improved Decoding for Discrete Diffusion Models via VI**   *Started Aug 2025*
  masked diffusion models (MDMs), variational inference (VI), LLM finetuning
  - Using variational methods to improve decoding/token-unmasking in discrete diffusion language models.

- **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.

- **Alan: Massively Parallel Probabilistic Programming Language**   *Started Jan 2023*
  probabilistic programming, numerical programming, Monte Carlo methods   [alan-ppl/alan 🐙]
  - Provides a simple interface for performing fast and accurate "Massively Parallel" Bayesian inference on general, user-specified probabilistic models. Optimised for GPUs with complexities of inference hidden from the user.
  - 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). *Proceedings of the 42nd International Conference on Machine Learning, PMLR 267:81143-81184.*

[AABI]   **Massively Parallel Expectation Maximization For Approximate Posteriors**.
Thomas Heap, Sam Bowyer, Laurence Aitchison (2025). *Proceedings of the 7th Symposium on Advances in Approximate Bayesian Inference, PMLR 289:25-66.*

[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
  - **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** *Nov 2024*
  Team project at Entrepreneur First/Valence Labs Bio x AI Hackathon [luka-kovacevic/moracle ⭕]
  - Awarded second place: £3000 in Nebius GPU credits and lunch with EF founder Matt Clifford.
  - Web tool for predicting a molecule's clinical viability using protein-binding affinity and historical clinical trial data.
  - Worked in a five-person team with 30 hour time limit to research, plan, construct and present a proof-of-concept.

- **Other PhD Research Projects** *Jul 2024 - Aug 2025*
  Research projects I've worked on that haven't led to papers, but from which I've learnt a great deal
  - Stein Variational Gradient Descent (SVGD) for Bayesian finetuning of LLMs with LoRA. See Compass blog [🔗].
  - LLM interpretability via Bayesian hierarchical modelling of evals. See presentation [🔗]
  - Postraining LLMs via Q-Learning from next-token logits. See Github repo [sambowyer/QPO ⭕].

- **Reinforcement Learning for Tournament Structures** *Oct 2021 - May 2022*
  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.

- **Pitch Detection and Phase Vocoder** *Oct 2020 - May 2021*
  3rd year MSci Computer Science Project [sambowyer/pitchcontrol ⭕]
  - Implemented various pitch detection algorithms and a phase vocoder in Python to pitch-shift and -correct audio files.

OTHER ACTIVITIES

- **Reviewing for UAI 2025** *Mar 2025*

- **Presentations** *Sep 2022 - Present*
  Regularly present talks on various topics in machine learning [sambowyer/presentations ⭕]
  - Internal lab meeting talks ranging from in-depth discussion of a single paper (e.g. Kolmogorov-Arnold-Networks (KANs) [🔗]) to overviews of whole areas (e.g. Simulation Based Inference (SBI) [🔗]).
  - Other talks include Compass Conference Lightning Talks on LLM Finetuning via LoRA, and Uncertainty Quantification for LLM Evals (also presented an extended version of the latter at an external lab's reading group).

- **Compass Student Blog** *Aug 2024*
  Bayesian LLM Finetuning [🔗]
  - 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 CDT Event Organising**
  - Helped organise various events for the Compass CDT: three-day long Away Day 2024 [🔗]; two-day long writing retreat 2025 [🔗]; Compass Conference 2025 [🔗]. Also organise fortnightly seminars among Compass students.

CONFERENCES AND ACADEMIC EVENTS

- **ICML 2025** *Jul 2025*
- **ICLR 2025** *Apr 2025*
- **AABI 2024 & 2025** *Jul 2024 & Apr 2025*
- **AIUK 2025 (Turing Institute)** *Mar 2025*
- **UAI 2024** *Jul 2024*
- **Turing CDT Conference 2023** *Nov 2023*
- **Compass Conference 2022-2025** *2022 - 2025*
- **APTS (Academy for PhD Training in Statistics)** *Dec 2022 - Aug 2023*

INTERESTS

I'm a keen runner (currently training for my first marathon) and regularly go bouldering and play badminton with friends. 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.

References available on request.