Hayder Elesedy

hayder.ai | github.com/brynhayder | hayder.elesedy@gmail.com

Education

10/18 – 06/23 **DPhil Machine Learning** Department of Computer Science, University of Oxford

Thesis: *Symmetry and Generalisation in Machine Learning*

Supervised by Varun Kanade and Yee Whye Teh. Worked on equivariance in machine learning, the lottery ticket hypothesis, SGD, ML theory and applications to science. Integrated master's 2018-19. Passed without corrections.

10/11 – 06/15 **MSc. Mathematics with Astrophysics** Jesus College, University of Cambridge, 1st

Courses in mathematics and theoretical physics including probability, algebra, analysis, (differential) geometry, integrable systems, quantum field theory and general relativity.

Master's Thesis: *Timescales of Galaxy Mergers and Satellite Stripping*, 1st

Computational investigation of galaxy merger time scales and rates of mass accretion.

Experience

07/25 – **Research Engineer, Fundamental**

Foundation models for tabular data.

11/23 – 12/24 **Senior Machine Learning Researcher, Samsung**

Research in LLM safety (efficient guardrail systems) and differentially private, federated estimation. I invented LoRA-Guard (see preprint 9). This was a fixed-term contract.

08/22 – 12/22 **Research Scientist Intern, DeepMind**

Research on (adaptive) clipping methods for SGD with applications to deep learning and online learning. Supervised by Marcus Hutter. See preprint 7. The code I wrote for this project was used elsewhere internally.

06/21 – 12/21 **AI Resident, X** (formerly Google [x])

Deep learning and graph neural networks for biology. Worked on the early stages of A-Life. Supervised by David Duvenaud.

04/20 – 12/20 **Action Team, Royal Society DELVE Initiative**

Multi-disciplinary team convened by Royal Society to provide data-driven assistance in confronting the COVID pandemic. Results instrumental to policy decisions at top levels of UK government (SAGE, Cabinet Office, PM). See publications 2 and 3.

05/16 – 05/18 **Quantitative Researcher, Tudor Investment Corporation**

05/16 – 01/18: Research and signal construction for systematic macro trading. Additionally: built a custom stack for developing and backtesting trading strategies, portfolio optimisation infrastructure and event driven automations including real time election prediction and live text analysis of central bank releases. 01/18 – 05/18: Worked in the highest performing discretionary team. Automated analytics and machine learning for time series forecasting. Built successful Gaussian process model of US CPI with predictions traded live.

Selected Publications & Preprints

Note: previously I used my Welsh name, Bryn. For a complete list, see my Google Scholar page.

9. *LoRA-Guard: Parameter-Efficient Guardrail Adaptation for Content Moderation of Large Language Models*. **Hayder Elesedy**, Pedro M. Esperança, Silviu Vlad Oprea, Mete Ozay. EMNLP, 2024. link

8. *Symmetry and Generalisation in Machine Learning*. **Hayder Elesedy**. PhD Thesis, 2023. link

7. *U-Clip: On-Average Unbiased Stochastic Gradient Clipping*. **Bryn Elesedy**, Marcus Hutter. Preprint, 2023. link

6. *Group Symmetry in PAC Learning*. **Bryn Elesedy**. Geometrical and Topological Representation Learning Workshop, ICLR 2022 (Spotlight). link

5. *Provably Strict Generalisation Benefit for Invariance in Kernel Methods*. **Bryn Elesedy**. NeurIPS 2021. link

4. *Provably Strict Generalisation Benefit for Equivariant Models*. **Bryn Elesedy** and Sheheryar Zaidi. ICML 2021. link

3. *Efficient Bayesian Inference of Instantaneous Reproduction Numbers at Fine Spatial Scales, with an Application to Mapping and Nowcasting the COVID-19 Epidemic in British Local Authorities*. Yee Whye Teh, Avishkar Bhoopchand, Peter Diggle, **Bryn Elesedy**, Bobby He, Michael Hutchinson, Ulrich Paquet, Jonathan Read, Nenad Tomasev, Sheheryar Zaidi (YWT then alphabetical ordering). Royal Society Special Topic Meeting on R, Local R and Transmission of COVID-19. Website: localcovid.info. link

2. *Effectiveness and resource requirements of test, trace and isolate strategies for COVID in the UK*. Bobby He[*], Sheheryar Zaidi[*], **Bryn Elesedy**[*], Michael Hutchinson[*], Andrei Paleyes, Guy Harling, Anne Johnson, Yee Whye Teh on behalf of Royal Society DELVE group (* equal contribution). Royal Society Open Science, 2021. link

1. *Lottery Tickets in Linear Models: An Analysis of Iterative Magnitude Pruning*. **Bryn Elesedy**, Varun Kanade, Yee Whye Teh. Sparsity in Neural Networks Workshop, 2021. link

Key Skills

- Deep understanding of machine learning from foundations to fronteir, bridging theory and practice. Experience in deep learning (inc. LLMs) with PyTorch and JAX. Experience applying machine learning in industry settings, including data processing and validation.
- Strong engineering skills with experience in research and production. Fluent in Python and data/ML ecosystem (NumPy, pandas, matplotlib, scikit-learn, . . .). Experience with Unix environment (Bash), test driven development, continuous integration and using version control collaboratively (Git, Mercurial). Basic experience in C++ and other tools.
- Motivated to understand and be useful. Curious and practically minded, with an emphasis on rigour and intellectual honesty. Natural communicator and team player.

Awards & Service

- **Awards**: ⋆ G-Research PhD Prize, 2nd Place, 2022, £5000 ⋆ Alan Turing Institute Enrichment Scheme Scholarship, 2020, £7000 (cancelled due to pandemic) ⋆ Jesus College Educational Board Prize, 2015, £150 ⋆ College Scholarship, 2015, £100
- **Service**: ⋆ Practicals Committee, Deep Learning Indaba 2023 & 2024 ⋆ Reviewer: AISTATS 2020, Neural Networks (Elsevier) 2023 ⋆ TA for B8.4 Information Theory at the Mathematical Institute, University of Oxford, Hilary Term 2021 ⋆ Guest speaker for the course Machine Learning and the Physical World, University of Cambridge, 2020. Joint with Andrei Paleyes ⋆ Organiser of OxCSML Deep and Probabilistic Learning Reading Group, 2019-2020 ⋆ Tuition and Oxbridge entrance assistance for disadvantaged students, 2015-2018