Jamie McGowan

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Versatile Research Scientist with a strong theoretical background and extensive hands-on experience with training phases of neural networks. My overarching research focus has been to develop a deeper understanding of how and why deep neural networks learn across multiple modalities and use this to inform the next generation of AI.

Experience

MediaTek Research — *Research Scientist*   Oct 2022 - Present

As a Research Scientist, my work spans a range of foundational AI topics, including optimization, test-time adaptation, meta-learning, structured intelligence, and representation learning. My work bridges theoretical and practical advancements with the aim of tackling risky problems for our parent company, MediaTek, which could be important on a 5+ year timescale. I work within a small team and have conducted and led research projects on optimization and efficient algorithm design for both pre-training and post-training applications. In my role, I have worked with a variety of data modalities, including vision, natural language, and code, and I have maintained active collaborations with academic partners at both the University of Cambridge and University College London.

- First author papers at NeurIPS aimed towards improving our theoretical understanding of learning algorithms using second-order information.
- Developed scalable AI applications for the chip design process, including hardware verification techniques and fine-tuned LLMs on Verilog.
- Led and co-authored research on model compression, in collaboration with UCL researchers.

University College London — *Postdoctoral Researcher*   Jan 2022 - Oct 2022

Industry funded fellowship to work collaboratively with the Machine Learning team at ASOS (one of the UK's largest online fashion retailers), building a system to predict customer returns using Graph Neural Networks.

- Acted as a senior researcher, leading a team consisting of PhD students, Master's students and consulting with engineers at ASOS.
- Project resulted in 3 Master's theses on which I was the primary supervisor.
- Helped ASOS ML engineers to implement our graph-based solution in production, with an automated sizing recommendation provided to customers based on our predictions.
- Worked with data scientists at ASOS to publish a dataset to encourage further work on recommendation systems with structured data.

MediaTek Research — *Research Intern*   June 2020 - Sep 2020

Meta-Learning project based on an adaptation of the MAML algorithm for hierarchical learning. Our new algorithm, TreeMAML, achieved superior performance compared to similar meta-learning algorithms on natural language tasks by exploiting prior knowledge of the language tree.

- I was responsible for designing a soft clustering algorithm which performed efficient online top-down clustering of language tasks, using a measure of probability that the task belonged to an existing cluster.
- Co-authored and published the paper Cross-Lingual Transfer with MAML on Trees in ACL 2021.

ICML Local Meet-up — *Local Organising Committee*   May 2024 - Present

In order to inspire more engagement and collaboration in the London area, I set up a local organising committee for ICML which is funded by my own company, MediaTek Research, the UCL ELLIS unit, and the UCL Centre for Data Intensive Science in Industry.

- Organised a series of talk sessions and two poster sessions with researchers from both industry and academia.
- Due to its success, I have expanded the committee to include academics from UCL Centre for AI and secured an agreement to fund the event annually from our company.

Education

Theoretical Physics — *Ph.D.*   Sep 2018 - May 2022

University College London, UK, Focus: Particle Physics Theory & Phenomenology — Advisor: Prof. Robert Thorne

Theoretical Physics — *M. Phys. (Hons)*   Sep 2014 - June 2018

University of Leeds, UK, Focus: Grand Unification Theories — Top 2% of cohort

Technical Projects

The Alan Turing Institute — *Rabbit-Hole Reccommendation System*   Apr 2021 - May 2021

Collaborative project in a multidisciplinary team to define and develop a solution for recommendation of niche podcasts based on recently listened to podcasts.

- Cleaned a multimodal dataset and worked collaboratively with product owners at Entale, a podcast provider, to design a novel 'rabbit hole' style personalized recommendation system.

- Developed a word2vec style solution with a Latent Dirichlet Allocation model. We achieved our goal by comparing podcast description vectors with inverse frequency sampled words from recently listened to podcast transcriptions.

UK Atomic Energy Authority (UKAEA) — *Automatic Image Calibration* JAN 2019 - MAY 2019

Calibration of images from 'shaky' cameras inside a fusion reactor could be automated.
- Extensive pre-processing of images using libraries such as OpenCV, to clean or discard static frames 'on-the-fly'.
- Used a technique named 'DeepMatching', inspired by convolutional architectures to efficiently determine the dense correspondences between two frames.

Personal Project — *Deep Dreams* AUG 2021 - SEP 2021

Fun project exploring Style Transfer for images using VGG19 convolutional architecture as the backbone. This technique can be used to combine two images by defining a style loss and a content loss and training the network to convergence given an image for each loss term.
- Open-sourced a repository that can be used to create cool artwork locally using a technique called style transfer.
- Blog post published in Towards Data Science on Medium.

Personal Project — *PyTorch Lightning LLM Template Project* NOV 2024 - DEC 2024

Reusable PyTorch Lightning template project for getting started with conducting experiments with LLMs. Primarily set up for the GPTNeoX codebase but can be easily extended to other models.
- Open-sourced a version of a repository that I use for my own experiments in the hope that it reduces a barrier to entry for other users using the PyTorch Lightning CLI.
- Can support distributed training across multiple GPUs and is completely configurable from configuration files or the CLI.
- Blog post to follow soon!

SKILLS

- **Soft:** Problem Solving, Communication, Creativity, Leadership, Organisation, Versatility
- **Programming:** Python, PyTorch, TensorFlow, Keras, Huggingface Git, LaTeX
- **Technologies:** Deep Learning, Optimization, Meta-Learning, AI for Hardware, Generative Modelling, Linear Algebra

AWARDS & CERTIFICATES

DEC 2023 *High Energy Physics Prize* — Awarded to the best thesis of the year.

JUN 2018 *Deans List* — Awarded every year from 2014 to 2018 for being in the top 10% of students in my cohort.

JUN 2018 *Research & Leadership Scholarship* — Awarded to 2 students across the faculty (~ 1000 students) for research excellence and to fund summer research placements.

SELECTED PUBLICATIONS

- **Exact, Tractable Gauss-Newton Optimization in Deep Reversible Architectures** *NeurIPS* (2024)
  J. McGowan, D. Buffelli, W. Xu, A. Cioba, D. S. Shiu, G. Hennequin, and A. Bernacchia
- **Efficient Model Compression Techniques with FishLeg** *NeurIPS, Neural Compression* (2024)
  J. McGowan, W. S. Lai, W. Chen, H. Aldridge, J. Clarke, J. R. Garcia, R. Xia, Y. Liang, G. Hennequin, and A. Bernacchia
- **Combination of aN^{3}LO PDFs and Implications for Higgs Production at the LHC** *Pre-print* (2024)
  T. Cridge, L. Harland-Lang, **J. McGowan**, R. Thorne, et. al.
- **A Dataset for Learning Graph Representations to Predict Customer Returns** *ACM Conference on Recommender Systems, FashionXRecSys* (2023)
  J. McGowan, E. Guest, Z. Yan, C. Zheng, N. Patel, M. Cusack, C. Donaldson, S. de Cnudde, G. Facini, and F. Dzogang
- **Approximate N^{3}LO Parton Distribution Functions with Theoretical Uncertainties** *Eur. Phys. J. C* (2023)
  J. McGowan, T. Cridge, L. Harland-Lang, and R. Thorne
- **Cross-Lingual Transfer with MAML on Trees** *Association for Computational Linguistics, AdaptNLP* (2021)
  J. R. Garcia, F. Freddi, **J. McGowan**, T. Nieradzik, F. T. Liao, Y. Tian, D. S. Shiu, and A. Bernacchia.

POPULAR SCIENCE ARTICLES

- **The theory and concepts behind Diffusion Models** *Expected Dec 2024*
- **How to train your LLM with Lightning** *Expected Dec 2024*
- **Gradient Descent: Optimization and Initialisation Explained** *Towards Data Science*
- **Topic Model Based Recommendation Systems** *Towards Data Science*
- **Can Machines Dream?** *Towards Data Science*
- **What Actually Happens in a Particle Collision?** *Particle Physics 101*
- **A Deep Dive into Imagen** *Towards Data Science*
- **AGI, AI, DL, ML. . . What's the Difference?** *The Startup*