Jamie McGowan

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EDUCATION

Theoretical Physics — *Ph.D.* SEP 2018 - MAY 2022

University College London, UK, Focus: Particle Physics Theory & Phenomenology — Advisor: Prof. Robert Thorne
Thesis: "Approximate N^3LO Parton Distribution Functions with Theoretical Uncertainties" — Won Best Thesis Award

Theoretical Physics — *M. Phys. (Hons)* SEP 2014 - JUNE 2018

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

EXPERIENCE

MediaTek Research — *Research Scientist/Engineer* OCT 2022 - PRESENT

My work spans a range of foundational AI topics, including optimization, test-time adaptation, meta-learning, and representation learning. In my role, my time is spent bridging theoretical and practical advancements with the aim of tackling risky problems for research purposes or for internal usage by parent company, MediaTek. I have conducted and led research projects focussed on the transformer architecture and LLMs while flexibly switching between Research Scientist and Engineer tasks – directly developing and implementing scalable solutions in distributed systems.

- First author papers at NeurIPS aimed towards improving our theoretical understanding of learning algorithms using second-order information.
- Maintained active collaborations with academic partners at both the University of Cambridge and University College London.
- Worked on projects related to incorporating AI into the chip design pipeline, for internal usage.
- Working towards proposing and implementing new methods for incorporating multi-modal memory systems into LLMs by leveraging test-time compute and latent space reasoning.

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 of PhD and MSc students, while consulting with engineers at ASOS.
- Project resulted in three MSc 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 phylogenetic 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: 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.

TECHNICAL PROJECTS

The Alan Turing Institute — *Rabbit-Hole Recommendation System* APR 2021 - MAY 2021

Collaborative project in a multidisciplinary team to define and develop a solution for recommendation of 'niche' podcasts based on a users recent listening history.

- 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 artwork locally using a technique called style transfer.
- Blog post published in Towards Data Science on Medium.

Personal Project — *How to train your LLM with Lightning* NOV 2024 - PRESENT

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!

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.

SKILLS

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

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 aN³LO 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 N³LO 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**
- **How to Train your LLM with Lightning** *Expected Feb 2025*
- **Parallel Training the Transformer Architecture** *Expected Feb 2025*
- **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*