Adam Ibrahim

Interests

Mathematics: Topology, Algebra, Measure Theory, Number Theory
Computer Science: Machine Learning, Algorithms and Optimisation, Quantum Computing, Cryptography
Physics: Theoretical Physics, Computational Physics

Programming Skills

Python, C/C++, C#, Unity, MATLAB, R, LaTeX

Languages

Native/bilingual proficiency: French, Arabic, English
Limited working proficiency: Spanish
Elementary proficiency: German (currently learning)

Extra-curriculars

Gym, Rock climbing, Motorcycling (track), Scuba diving, Piano, Guitar

Work Experience

06/24 - Now — H
Core team researcher.

01/24 - 05/24 — Zyphra
Consulting on pretraining and finetuning foundation models (mixture-of-experts, LLMs, and image generation).

05/23 - 12/23 — Bosch
Mentoring/supervising confidential research project on foundation models for scene understanding as external consultant.

05/23 - 12/23 — Optina Diagnostics
Mentoring/supervising two confidential research projects on image generation and self-supervised learning for computer vision as external consultant.

05/23 - 11/23 — Staples
Mentoring/supervising confidential research project on Large Language Models as external consultant.

06/23 - 09/23 — Blackbox AI
Consulting for the development of Large Language Models for code.

05/22 - 12/22 — AMD
Mentoring/supervising confidential research project on reinforcement learning and exploration as external consultant.

02/22 - 06/22 — Microsoft
Mentoring/supervising confidential research project on speech recognition as external consultant.

05/21 - 12/21 — Apple, Cupertino
Mentoring/supervising confidential research project on multimodal machine learning in hardware-constrained environments as external consultant.

Summer 2016 — Anasys Instruments
Design and optimisation of computer vision and signal processing algorithms for the Analysis Studio software (C# / C++). Design of computer vision algorithms for a healthcare related NDA project.

Education

2018 - 2024 **Doctor of Philosophy** — Mila, Université de Montréal, Canada
Machine Learning, under the supervision of Pr. Ioannis Mitliagkas and Irina Rish. GPA: 4.30/4.30.

2015 - 2018 **Master of Science** — University of California, Santa Barbara, USA
Computer Science. Areas of focus: Machine Learning, Human-Computer Interaction, Computer Vision, Cryptography. GPA: 4.0/4.0.
Relevant graduate courses: CS 595I Advanced Machine Learning seminar, CS 290I Deep Learning, CS 292F Foundations of Data Science, MATH 260J Foundations of Machine Learning, ECE 210A Matrix Analysis, CS 240A Parallel Computing.

2012 - 2015 **Bachelor of Science** — McGill University, Montreal, Canada
Joint Honours Mathematics and Physics. First-class honours.
Relevant graduate courses: General Relativity, Introduction to String Theory, Group Theory, Topics in Topology, Quantum Field Theory, Very Early Universe.

2011 - 2012 **MPSI** Collège Stanislas, Paris, France
Preparatory school. Main subjects: Mathematics, Physics, Engineering, specialisation Computer Science.

2011 **Baccalauréat Scientifique** Lycée Saint-Charles, Orléans, France
Bilingual French/English Secondary School. Passed all of the Cambridge English proficiency exams, including the Certificate of Proficiency in English.

Research Experience

06/24 - Now H
Core team researcher.

09/18 - 06/24 Mila, Université de Montréal
Research in optimisation, out-of-distribution generalisation and adversarial machine learning, and continual learning. Ongoing work on Large Language Models as part of the 2023 INCITE Allocation program by the US Department of Energy. Interests in reinforcement learning.

01/24 - 05/24 Zyphra
Consulting on pretraining and finetuning foundation models (mixture-of-experts, LLMs, and image generation).

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05/21 - 12/21 Apple, Cupertino
Mentoring/supervising confidential research project on multimodal machine learning in hardware-constrained environments as external consultant.

03/16 - 06/18 Four Eyes lab, UC Santa Barbara
Research in recommender systems and in particular the perception of recommendations in Augmented Reality. Language learning project in Augmented Reality using machine learning to recognise objects in the environment in order to provide situated and personalised learning. Design of computer vision algorithms based on deep learning to allow users of Augmented Reality devices to select objects in the environment. Designed and conducted user studies to test the potential of Augmented Reality as a vocabulary learning medium.

09/14 - 04/15 David Cooke group, McGill University
THz photons trapped in dynamical optically-pumped cavities in silicon materials. Worked in a group to test numerically the consistency of the results with the theory using an FDTD algorithm.

05/14 - 04/15 Keshav Dasgupta, McGill University
Investigating whether string theoretical monodromy inflation can be uplifted to a de Sitter universe.

05/13 - 09/13 Robert Brandenberger, McGill University

Probing for cosmic string wakes signatures in the CMB using Canny's algorithm and analytical methods. Attended the weekly research meetings of the cosmology group until 2015.

Publications

2024 **Zyda: A 1.3 T Dataset for Open Language Modeling** Technical report (arXiv)
Yury Tokpanov, Beren Millidge, Paolo Glorioso, Jonathan Pilault, Adam Ibrahim, James Whittington, Quentin Anthony

2024 **Why Has Predicting Downstream Capabilities of Frontier AI Models with Scale Remained Elusive?** Under review NeurIPS 2024, presented at ICML 2024 workshops
Rylan Schaeffer, Hailey Schoelkopf, Brando Miranda, Gabriel Mukobi, Varun Madan, Adam Ibrahim, Herbie Bradley, Stella Biderman, Sanmi Koyejo

2024 **Zamba: A Compact 7B SSM Hybrid Model** Technical report (arXiv)
Paolo Glorioso, Quentin Anthony, Yury Tokpanov, James Whittington, Jonathan Pilault, Adam Ibrahim, Beren Millidge.

2024 **Simple and Scalable Strategies to Continually Pre-train Large Language Models** TMLR
Adam Ibrahim*, Benjamin Thérien*, Kshitij Gupta*, Mats Leon Richter, Quentin Gregory Anthony, Timothée Lesort, Eugene Belilovsky, Irina Rish.
A * denotes equal contribution.

2023 **Continual Pre-Training of Large Language Models: How to Re-warm Your Model?** ESFoMo ICML 2023, ENLSP NeurIPS 2023
Kshitij Gupta*, Benjamin Thérien*, Adam Ibrahim*, Mats Leon Richter, Quentin Gregory Anthony, Eugene Belilovsky, Timothée Lesort, Irina Rish.
A * denotes equal contribution.

2022 **Towards Out-of-Distribution Adversarial Robustness** arXiv preprint
Adam Ibrahim, Charles Guille-Escuret, Ioannis Mitliagkas, Irina Rish, David Krueger, Pouya Bashivan.

2022 **Learning Robust Kernel Ensembles with Kernel Average Pooling** arXiv preprint
Pouya Bashivan, Adam Ibrahim, Amirozhan Dehghani, Yifei Ren

2022 **Gradient Descent Is Optimal Under Lower Restricted Secant Inequality And Upper Error Bound** NeurIPS 2022
Charles Guille-Escuret, Adam Ibrahim, Baptiste Goujaud, Ioannis Mitliagkas.

2022 **Towards Generalisable Robustness: A Domain Generalisation Approach** ICML 2022 AdvML
Adam Ibrahim, Charles Guille-Escuret, Ioannis Mitliagkas, Irina Rish, David Krueger, Pouya Bashivan.

2021 **Adversarial Feature Desensitization** NeurIPS 2021
Pouya Bashivan, Reza Bayat, Adam Ibrahim, Kartik Ahuja, Mojtaba Faramarzi, Touraj Laleh, Blake Richards, Irina Rish.

2020 **Linear Lower Bounds and Conditioning of Differentiable Games** ICML 2020
Also presented at MAIS 2019, DeepMath 2019 and NeurIPS 2019 SGO workshop
Adam Ibrahim, Waïss Azizian, Gauthier Gidel, Ioannis Mitliagkas.

2019 **User Perception of Situated Product Recommendations in Augmented Reality** International Journal of Semantic Computing 13 (03)
Brandon Huynh, Adam Ibrahim, Yun Suk Chang, Tobias Höllerer, John O'Donovan.

2018 **ARbis Pictus: A Study of Vocabulary Learning with Augmented Reality** ISMAR 2018
Also published as a journal paper in IEEE transactions on visualization and computer graphics 24 (11)
Adam Ibrahim, Brandon Huynh, Jonathan Downey, Tobias Höllerer, Dorothy Chun, John O'Donovan.

2018 **A Study of Situated Product Recommendations in Augmented Reality** AIVR 2018
Brandon Huynh, Adam Ibrahim, Yun Suk Chang, Tobias Höllerer, John O'Donovan.

Talks

05/23/24 **Improving the Efficiency of Large Language Model Pretraining** Meta

02/07/23 **Towards Out-of-Distribution Adversarial Robustness** Microsoft Research

07/05/19 **Linear Lower Bounds and Conditioning of Differentiable Games** Montreal MLOpt

05/11/17 **Motivating Convolutional Neural Networks** Microsoft Station Q

Awards

Bourse en Intelligence Artificielle (IA) des ESP Université de Montréal

Natural Sciences and Engineering Research Council of Canada

Trottier-Lavigne Physics Department Award

Edward Beatty Scholarship in Mathematics

John V Galley Scholarship in Mathematics

Dean's Honour List

Organisational skills

12/15/2023 **6th Neural Scaling Laws Workshop** NeurIPS 2023
Workshop colocated with NeurIPS 2023. Co-organised with Irina Rish, Julia Bossmann, and the CERC-AAI team.
Link: `https://sites.google.com/mila.quebec/6thnslw-no/home`

07/28/2023 **Emergent Behaviours and Phase Transitions in Deep Learning** ICML 2023
Workshop colocated with ICML 2023. Co-organised with Irina Rish, Guillaume Dumas, Mohammad Pezeshki, Pascal J. Tikeng Notsawo, Hattie Zhou, Gabriela Moisescu-Pareja, Ethan Caballero, Yi Ren, Eric Michaud.
Link: `https://sites.google.com/mila.quebec/5thnslw`

12/02/2022 **4th Neural Scaling Laws Workshop** NeurIPS 2022
Unofficial workshop held during NeurIPS on Friday 2nd, 2022. Co-organised with Irina Rish. You are encouraged to attend or reach out for more information!
Link: `https://sites.google.com/mila.quebec/4thnslw/home`

2019-2021 **Deep Learning Theory / Out-of-Distribution Generalisation Reading Group** Mila

Teaching Assistant Experience

Spring 2018	**CS 178 Introduction to Cryptography**	UC Santa Barbara, USA
Winter 2018	**CS 130B Data Structures and Algorithms II**	UC Santa Barbara, USA
Fall 2017	**CS 174A Fundamentals of Database Systems**	UC Santa Barbara, USA
Summer 2017	**CS 16 Problem Solving with Computers 1**	UC Santa Barbara, USA
Spring 2017	**CS 165B Machine Learning**	UC Santa Barbara, USA
Winter 2017	**CS 181B Introduction to Computer Vision**	UC Santa Barbara, USA
Fall 2016	**CS 40 Foundations of Computer Science**	UC Santa Barbara, USA
Summer 2016	**CS 16 Problem Solving with Computers 1**	UC Santa Barbara, USA
Spring 2016	**CS 24 Problem Solving with Computers 2**	UC Santa Barbara, USA
Winter 2016	**CS 16 Problem Solving with Computers 1**	UC Santa Barbara, USA
Fall 2015	**CS 16 Problem Solving with Computers 1**	UC Santa Barbara, USA
2014	**MATH 381 Complex Variables and Transforms for Engineers**	McGill University
2013 & 2014	**MATH 249 Honours Complex Variables**	McGill University

Conferences Attended

05/24	**2024 ICLR International Conference on Learning Representations**
12/23	**2023 NeurIPS Neural Information Processing Systems** Presentation of *Continual Pre-Training of Large Language Models: How to Re-warm Your Model?* at workshops.
07/23	**2023 ICML International Conference on Machine Learning** Presentation of *Continual Pre-Training of Large Language Models: How to Re-warm Your Model?* at the Efficient Systems for Foundation Models workshop and *Towards Out-of-Distribution Adversarial Robustness* at the New Frontiers in Adversarial Machine Learning workshop.
12/22	**2022 NeurIPS Neural Information Processing Systems** Poster presentation of *Gradient Descent Is Optimal Under Lower Restricted Secant Inequality And Upper Error Bound*.
08/22	**2022 CoLLAs Conference on Lifelong Learning Agents**
07/22	**2022 ICML International Conference on Machine Learning** Poster presentation of *Towards Generalisable Robustness: A Domain Generalisation Approach* at the New Frontiers in Adversarial Machine Learning workshop.
20-22 COVID	**Attended the virtual NeurIPS, ICML and ICLR conferences.**
07/20	**2020 ICML International Conference on Machine Learning** Poster presentation of *Linear Lower Bounds and Conditioning of Differentiable Games*.
10/19	**2019 DeepMath Conference on the Mathematical Theory of Deep Neural Networks** Poster presentation of *Linear Lower Bounds and Conditioning of Differentiable Games*.
09/19	**2019 MAIS Montreal AI Symposium** Poster presentation of *Linear Lower Bounds and Conditioning of Differentiable Games*.
12/18	**2018 NeurIPS Neural Information Processing Systems**
10/18	**2018 ISMAR International Symposium on Mixed and Augmented Reality** Oral presentation of *ARbis Pictus: A Study of Vocabulary Learning with Augmented Reality*.
12/17	**2017 NeurIPS Neural Information Processing Systems**

10/17 **2017 South California Machine Learning Symposium (USC)**

03/17 **2017 IEEE VR 3DUI Conference on Virtual Reality and 3D User Interfaces**