Mahmoud Assran (Mido)

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Academic Interests

Efficient learning is a hallmark of human intelligence. We can learn concepts from few examples using a brain that runs on the energy-equivalent of an electric razor. I am interested in developing algorithms that enable computers to efficiently learn semantically meaningful representations of the world from fewer examples, and with less energy. To that end, I have focused on deep learning algorithms for self- and semi-supervised learning (i.e., deriving supervisory signals from data, rather than human annotations) and optimization algorithms for large-scale distributed computing.

Highlights

My early PhD work improved the computational efficiency of learning by developing theory and algorithms for large-scale stochastic optimization. My most recent work focuses on improving the data efficiency of learning by developing algorithms that can learn with less human supervision.

ICML'19 Develop a fast distributed optimization algorithm, τ-SGP, which speeds up supervised learning with large neural networks. We bridge two research communities and demonstrate for the first time that, in addition to reducing wall-clock time, gossip-based optimization algorithms can improve generalization on larger computer vision benchmarks like ImageNet.

NeurIPS'19 Develop an efficient distributed optimization algorithm, GALA, which speeds up deep reinforcement learning with many parallel simulators. We improve sample efficiency, framerates, and hardware utilization, and once again demonstrate the potential of gossip-based optimization algorithms to improve the computational efficiency of learning.

ICML'20 Provide the first formal proof that Nesterov acceleration with mini-batch gradients (a numerical optimization technique developed in the 1980's and commonly used in machine learning for model training) can in fact provably diverge for smooth strongly-convex finite-sums. This proof is constructive and provides insight into why Nesterov's method can fail to converge.

ICCV'21 Develop a data-efficient learning algorithm, PAWS, and achieve a new state-of-the-art for semi-supervised learning on the extremely competitive ImageNet benchmark. PAWS has connections to constructivist learning theories and establishes a new class of semi-supervised representation learning methods.

Research Experience

Facebook, AI Research		2017–present
Visiting Researcher, PhD	*2019–present*	
Research Assistant, PhD	*2018–2019*	
Research Intern, PhD	*Summer 2018*	
Graduate Researcher	*2017–2018*	

McGill, Computer Networks Research Lab	Summer 2016
Undergraduate Researcher in Engineering	

Manulife, RED Lab	Summer 2015
Solutions Prototype Developer	

Education

PhD, Electrical and Computer Eng. 2018–present
McGill University, Mila – Quebec AI Institute, Montréal, Canada
Advisors: Mike Rabbat, Mark Coates
CGPA: 4.0/4.0
Doctoral Awards:

$150,000	Vanier Scholarship, NSERC
$105,000	Alexander Graham Bell Scholarship, NSERC
$72,000	McGill Engineering Doctoral Award
$48,000	Les Vadasz Doctoral Fellowship
$3,000	Graduate Mobility Award

MEng, Electrical and Computer Eng. 2017–2018
McGill University, Montréal, Canada
Advisor: Mike Rabbat
Graduate Excellence Fellowship
CGPA: 3.9/4.0

BEng, Electrical and Computer Eng. 2012–2016
McGill University, Montréal, Canada
Advisor: Mike Rabbat
Dean's Honours & Top 5% of Faculty
CGPA: 3.9/4.0

Conference Reviewing

International Conference on Machine Learning (`ICML`)
2021   Expert Reviewer   *(Best Reviewer Award)*
2020   Reviewer   *(Top Reviewer Award)*
2019   Reviewer

Neural Information Processing Systems (`NeurIPS`)
2021   Expert Reviewer
2020   Reviewer   *(Best Reviewer Award)*
2019   Reviewer

Association for the Advancement of Artificial Intelligence Conference (`AAAI`)
2020   Reviewer   *(One of 12 Outstanding Reviewers Award)*

International Conference on Learning Representations (`ICLR`)
2022   Reviewer
2021   Reviewer

International Conference on Artificial Intelligence and Statistics (`AISTATS`)
2022   Reviewer

IFAC World Congress
2020   Reviewer

Journal Reviewing

Automatica

Journal of Artificial Intelligence Research (`JAIR`)

IEEE Transactions on Automatic Control

IEEE Transactions on Signal Processing

IEEE Transactions on Control of Network Systems

IEEE Transactions on Signal and Information Processing over Networks

IEEE Signal Processing Magazine

ReScience ICLR Reproducibility Challenge

Preprints

S. Sodhani, O. Delalleau, M. Assran, K. Sinha, N. Ballas, M. Rabbat.
A Closer Look at Codistillation for Distributed Training.
preprint, 2020.

Conference & Journal Papers

PA. McRae, P. Parthasarathi, M. Assran, S. Chandar.
Memory Augmented Optimizers for Deep Learning.
International Conference on Learning Representations (ICLR), 2022.

M. Assran, M. Caron, I. Misra, P. Bojanowski, A. Joulin, *N. Ballas, *M. Rabbat.
Semi-Supervised Learning of Visual Features by Non-Parametrically Predicting View Assignments with Support Samples. *(Oral, Top 3% of papers)*
International Conference on Computer Vision (ICCV), 2021.

M. Assran, M. Rabbat.
Asynchronous Gradient Push.
IEEE Transactions on Automatic Control (IEEE TAC), 2021.

M. Assran, A. Aytekin, H. Feyzmahdavian, M. Johansson, M. Rabbat.
Advances in Asynchronous Parallel and Distributed Optimization.
Proceedings of the IEEE (Proc. IEEE), 2020.

M. Assran, M. Rabbat.
On the Convergence of Nesterov's Accelerated Gradient Method in Stochastic Settings.
International Conference on Machine Learning (ICML), 2020.

M. Assran, J. Romoff, N. Ballas, J. Pineau, M. Rabbat.
Gossip-based Actor-Learner Architectures for Deep Reinforcement Learning.
Neural Information Processing Systems (NeurIPS), 2019.

M. Assran, N. Loizou, N. Ballas, M. Rabbat.
Stochastic Gradient Push for Distributed Deep Learning.
International Conference on Machine Learning (ICML), 2019.

M. Assran, M. Rabbat.
An Empirical Comparison of Multi-Agent Optimization Algorithms.
IEEE Global Conference on Signal and Information Processing (IEEE GlobalSIP), 2017.

Workshop Papers

M. Assran, N. Ballas, L. Castrejon, M. Rabbat.
Contrastive Pre-Training with Task Information.
Self-Supervised Learning Workshop, NeurIPS, 2020.

M. Assran, N. Loizou, N. Ballas, M. Rabbat.
Stochastic Gradient Push.
Systems for ML Workshop, NeurIPS, 2018.

M. Assran, M. Rabbat.
Convergence of Asynchronous Subgradient Push Under Bounded Delays.
Workshop on Advances in Distributed and Large-Scale Optimization, ECC, 2018. *Invited.*

Theses

M. Assran.
Asynchronous Subgradient Push: Fast, Robust, and Scalable Multi-Agent Optimization.
Masters Thesis, McGill University Libraries, 2018.

Community Service

Youth Engagement Through Engineering (YETE)   2020–present
Co-Founder and Managing Director
Founded a not-for-profit corporation to benefit Canadian communities by advancing youth
education and facilitating pathways for youth to post-secondary education; especially for
indigenous youth in Quebec. To date, during the COVID-19 pandemic, we have developed
and piloted a successful online after-school program at FACE high school in the English
Montreal School Board (EMSB), focused on project-based learning and constructivist
learning methodologies.

Engineers Without Borders, Youth Engagement   2013–2020
Director & Facilitator
Lead the Youth Engagement Venture in the Engineers Without Borders Montreal chapter.
Developed an interdisciplinary semester-long program and taught high school students,
in class, once a week, for their entire school semester. Personally delivered this curriculum,
with the support of my team, at 5 different schools in the English Montreal School
Board (EMSB), as well as at an indigenous school, on the Kahnawake Mohawk Reserve.
Worked closely with school boards, students, teachers, and principles to maximize learning
outcomes. Provided pro bono consulting services for the McGill Engineering Department
and the McGill Administration and Enrolment Services to develop culturally
relevant education programs for indigenous high school students with the ultimate goal
of increasing post-secondary enrolment, and established several long-term collaborations.
Also provided pro bono consulting services for the EMSB to integrate more project-based
learning across schools in Montreal.

International RoboCup   2018
Judge (Poster & Presentations)
Conducted interviews with ~60 international teams from over 30 countries, and judged
poster presentations to assess qualities such as novelty, team-working skills, poster design,
and technical impact.

Nonlinear Optimization (MATH 560)   2018
Grader
Served as a grader for Prof. Tim Hoheisel's graduate non-linear optimization class in
the math department at McGill University. Graded students' proofs in assignments and
midterms.

Signals and Systems (ECSE 221)   2015, 2016
Official Final Exam Review Facilitator
At the request of the department's student society, I volunteered to prepare and conduct
the final exam review session for the Signals and Systems (ECSE 221) course at McGill
University, for two consecutive years. The sessions typically had ∼40 students and lasted
about 6 hours. We stepped through theoretical topics and practice problems in this time.

Selected Talks

Advancing Artificial Intelligence: Learning Over Networks *Invited Talk

2019	Winnipeg, CA	*Indigenous Services Canada, NIITA*

Youth Engagement through Project-Based Learning *Invited Talk

2019	Montreal, CA	*English Montreal School Board Teachers' Professional Development*

Contrastive Pre-Training with Task Information

2020	*Online*	*Self-Supervised Learning Workshop, NeurIPS*
2020	*Online*	*Montreal MLOpt Research Group*
2020	*Online*	*Facebook AI Research Global All Hands*

On the Convergence of Nesterov's Accelerated Gradient Method in Stochastic Settings

2020	*Online*	*International Conference on Machine Learning (ICML)*
2020	*Montreal, CA*	*Montreal MLOpt Research Group*

Gossip-based Actor-Learner Architectures for Deep Reinforcement Learning

2020	*Online*	*Aggregate Intellect (ai.science) *Invited Talk*
2020	*Online*	*Mila RL Reading Group *Invited Talk*
2019	*Vancouver, CA*	*Neural Information Processing Systems (NeurIPS)*
2019	*Montreal, CA*	*Montreal AI Symposium (Top 10% of Accepted Papers)*

Stochastic Gradient Push for Distributed Deep Learning

2019	*Long Beach, US*	*International Conference on Machine Learning (ICML)*
2018	*Montreal, CA*	*Systems for ML Workshop, NeurIPS*

Convergence of Asynchronous Gradient Push under Arbitrary Bounded Delay

2019	*Pacific Grove, US*	*IEEE Asilomar Conference *Invited Talk*
2018	*Limassol, Cyprus*	*European Control Conference (ECC) *Invited Talk*

Honours & Awards

Vanier Canada Graduate Scholarship   2020
NSERC | $150,000
Awarded to only 9 doctoral students in Canada in the Computing Sciences over the pre-
vious 4 years; the Vanier CGS plays an important role in fulfilling the Government of
Canada's Science and Technology strategy to promote the development and application
of leading-edge knowledge, support the development of a world class workforce, and at-
tract and retain the world's top graduate students. Awarded to doctoral students who have
demonstrated strong leadership skills and a high standard of scholarly achievement in
graduate studies in the social sciences and humanities, natural sciences and engineering,
and health.

Alexander Graham Bell Canada Graduate Scholarship   2020
NSERC | $105,000
Ranked 16th out of 1878 doctoral applicants in Canada pursuing research in the natural sciences and engineering. Awarded to the top-ranked doctoral students in Canada, to ensure a reliable supply of qualified personnel to meet the needs of Canada's knowledge economy.

Les Vadasz Doctoral Fellowship   2018
McGill University | $48,000
Established in 2006 by the Vadasz Family Foundation to recruit outstanding students into the Faculty of Engineering's doctoral degree program.

McGill Engineering Doctoral Award   2018
McGill University | $72,000
This award aims to recruit the best and brightest new doctoral students from all over the world. Selection for this award is based on the excellence of a student's academic and research record, including publications, presentations and his or her potential to make a major impact on the quality of research in the Faculty of Engineering at McGill University and in the field of engineering.

Graduate Mobility Award   2018
McGill University
To support student engagement in international research experiences outside of McGill, this guaranteed voucher for the Graduate Mobility Award (GMA) helps cover expenses associated with a visit/stay at a research lab, field work abroad, and/or visit with a research collaborator.

Undergraduate Student Masters Award   2017
McGill University | $35,000
Competitive recruitment funding to assist in attracting and retaining high caliber undergraduate students with demonstrated academic excellence, as well as applied research experience, into the Faculty's research Graduate Programs.

Graduate Excellence Fellowship   2017
McGill University
Nomination for this award is at the discretion of the Department or School. Selection for this award is based on the excellence of a student's academic and research record.

Rhodes Scholar Finalist   2017
University of Oxford
One of 12 finalists selected for three available Rhodes Scholarships, an international postgraduate scholarship to study at the University of Oxford.

Ian McLachlin Prize for Entrepreneurship in Engineering   2017
McGill University
Established in 1998 by Ian McLachlin, B.Eng. 1960, to encourage Engineering students to undertake Entrepreneurial Studies. Awarded by the Faculty of Engineering.

Dean's Honour List   2014, 2015, 2016, 2017
McGill University
The Dean's Honour List for undergraduate students recognizes those who rank in the top 10% of the Faculty of Engineering, based on the combined GPA for all courses taken during the Fall and Winter terms.

Les Vadasz Award in Engineering   2016
McGill University
Awarded annually, by the Faculty of Engineering, to a student based on high academic standing with a preference given to an interest in, and contribution towards, engineering sustainability and/or design.

Accenture Prize in Engineering and Science   2016
McGill University
Awarded by the Faculty Scholarships Committees, upon recommendation of the respective departments, on the basis of academic excellence and demonstrated leadership qualities.

Faculty of Engineering Scholarship   2016
McGill University
Established in 1992 by the University to provide awards based on academic achievement to students in the top 5% of the Faculty. Granted by the Faculty of Engineering Scholarships Committee based on good academic standing.

Undergraduate Student Research Award   2016
NSERC
Undergraduate Student Research Award, granted by the university and the Natural Sciences and Engineering Research Council of Canada, based on the student's academic record, research aptitude, and merit.

John Howard Ambrose Award   2016
McGill University
Awarded by the Faculty of Engineering Scholarships Committee on the basis of merit to engineering students.

IEEE Signal Processing Society Winter School Scholarship   2016
IEEE Signal Processing Society
Awarded by the IEEE Signal Processing Society on the basis of merit to engineering students.

John Green Memorial Award   2016
McGill University
For the student with highest standing in the penultimate year of Honours Electrical Engineering. Awarded on the recommendation of the Department.

1st Place Waterloo Hardware Hackathon   2015
Google, O'Reilly, PCH | $55,000
(Awarded $5000 cash scholarship and $50,000 in product services; e.g., manufacturing, incorporation fees, etc.). Developed a solution and a prototype to provide Internet access to developing communities by utilizing a distributed data mesh with an offline search engine.

Christie Steinmetz Award   2014
McGill University
Awarded to a second year student in Electrical Engineering on the basis of academic performance and demonstration of exceptional promise as an engineer. Awarded on the recommendation of the Department.

McCaig Family Scholarship in Engineering   2014
McGill University
Awarded by the Faculty of Engineering to undergraduate students who have completed at least one year of the B.Eng. program on the basis of high academic standing.

Software Projects

Hitch | Distributed Algorithms and Mesh Networks   2015

Media coverage: http://farstuff.com/?powerpress_pinw=567-podcast

Won the Google-PCH Hardware Hackathon in Kitchener-Waterloo. Developed a distributed mesh network with a tree-based topology management and routing algorithm, a Chord distributed hash table, and a distributed search engine. The goal of the project is to develop a novel full-stack solution to provide connectivity in remote communities. I presented a proof of concept at the 2015 O'Reilly SOLID Conference, and completed the first prototype in 2016. The project was featured in several media outlets, including an interview with the Farsutff Podcast.

Fletcha | Social IOS Application   2014

Apple App Store

Developed an iPhone application with a novel triangulation algorithm allowing friends to find each other at large outdoor venues or music festivals. The algorithm computes a triangulation angle in real time, rotating an arrow on the screen pointing a user to their friend. The application was available on the Apple App Store for several years.

Extracurricular Interests

Soccer

I love to play soccer and, in my youth, had the honour of representing the province of Saskatchewan at the Canada Games and Western Canada Games broadcast on TSN. I also benefited from short training camps with Major League Soccer academy teams such as the Vancouver Whitecaps, the Montreal Impact, and Real Salt Lake FC, and competed in friendlies against EFL Championship academy teams such as Luton Town FC. I also played the 2012 and 2013 preseasons with the McGill University Men's Varsity Soccer Team.

Tennis

I also love to play tennis, and competed at the Rogers Junior Nationals Competition twice, on one occasion as the second seed from the province of Saskatchewan, and on the second occasion as the first seed. I am a certified Tennis Canada instructor now.

Running

I also enjoy running, and spent a semester training with the McGill University Varsity Track Team in long-sprints. During the pandemic, I also discovered a newfound passion for leisurely long-distance running.