Mahmoud Assran (Mido)

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Academic Interests

I am interested in the capability of computers to acquire a perceptual understanding of our world from limited human supervision. To that end, I have focused on deep learning algorithms for self-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 a distributed optimization algorithm, `GALA`, which speeds up deep reinforcement learning with many parallel simulators. We improve sample efficiency, frame-rates, and hardware utilization, and once again demonstrate the potential of gossip-based optimization algorithms to improve the computational efficiency of learning.

`ICML'20` Most machine learning algorithms employ a numerical optimization technique known as Nesterov acceleration, which was developed in the 1980's and has seen unprecedented application across numerous fields. Despite widespread use, there have been no definitive theoretical guarantees for this method when combined with mini-batch gradients (its common usage in machine learning), even in simple settings. We provide the first formal proof that Nesterov acceleration with mini-batch gradients 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 in these settings.

`ICCV'21` Develop the `PAWS` learning algorithm, 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 $\sim$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 previous 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 attract 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.