

## Courtney Y. Paquette (née Kempton)

Mathematics and Statistics Department, McGill University, Montreal, QC, Canada,

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Citizenship: United States

## Research Positions

### Assistant Professor, McGill University

Mathematics and Statistics, Montreal, QC, Canada, September 2020-present

### Research Scientist-Google Brain

Montreal, QC, Canada, September 2019-August 2020

### NSF Postdoctoral Fellowship, University of Waterloo

Combinatorics and Optimization Department, July 2018- September 2019

Waterloo, ON

- Advisor: Stephen Vavasis

### Post-doc, Lehigh University-Industrial and Systems Engineering

Bethlehem, PA, January 2018-July 2018

- NSF TRIPODS Postdoctoral position

Advisor: Katya Scheinberg

### Post-doc, Ohio State University-Mathematics

Columbus, OH, August 2017-December 2017

- Ross Assistant Professor (Postdoctoral position)

## Education

- B.S. (Mathematics and Finance) June 2011, University of Washington, Seattle
- Ph.D. (Mathematics) June 2017, University of Washington, Seattle.
  - Thesis: *Structure and complexity in nonconvex and nonsmooth optimization*
  - Advisor: Dmitriy Drusvyatskiy

## Teaching

- *McGill University, Montreal, QC (August 2020-present)*
  - Math 417/517 (Linear Optimization and honor's version), undergraduate (40 students), Fall 2022
  - Math 315 (Ordinary differential equations), undergraduate (130 students), Fall 2020, Fall 2021
  - Math 560 (Numerical optimization), graduate (20 students), Winter 2021, Winter 2022
  - Math 597 (Convex analysis and optimization), graduate (15 students), Fall 2021
- *Lehigh University, Bethlehem, PA (January 2018-May 2018)*

- ISE 417 (Nonlinear optimization), graduate (15 students), Spring 2018
- *The Ohio State University, Columbus, OH (August 2017-December 2017)*
  - Math 1152 (Calculus instructor), 3 sections, undergraduate (100 students), Fall 2017
- *Lead Teaching Assistant, University of Washington, Seattle WA (June 2016-August 2017)*
  - Organize and coordinate a 5-day TA orientation for incoming math graduate students
  - Advises incoming graduate students on skills in teaching as a TA Mentor
  - Supervises first year graduate students
- *Research Experience for Undergraduates (REU) Teaching Assistant University of Washington, Seattle WA, Summers 2011, 2012, 2015*
  - Assisted groups of 2-3 students in projects related to inverse problems
- *University of Washington, Seattle, WA, (September 2011-June 2017)*
  - Math 307 (Differential Equations instructor), undergraduate (50 students), Fall 2014, Spring 2014, Summer 2014, Spring 2015, Winter 2016
  - Math 125 (Integral calculus TA), undergraduate (60 students), Fall 2011, Winter 2015
  - Math 124 (Differential calculus TA), undergraduate (60 students), Winter 2012, Spring 2012, Fall 2015

## Research and Scholarships

### Grants

1. FRQNT New university researcher's start-up program, PI (\$50,800; 2022-2024)
2. NSERC Discovery Grant and Supplemental for Early Career, PI (\$157,500; 2022-2027)
3. NSERC CREATE, co-applicant (\$1.65 million, 2022-2028)
4. CIFAR AI Chair, MILA, PI (\$500,000; 2020-2025)

### Fellowships

1. NSF Postdoctoral fellowship (July 2018-July 2019)
2. Tanzi-Egerton Fellowship Award (2016)
3. Excellence in Teaching Award (UW Math department) (2012)

### Awards

1. CIFAR's Rising Star in AI, Winter 2022 (Reach Magazine)  
<https://cifar.ca/publications-reports/reach/>
2. NeurIPS 2021 Outstanding Reviewer Award: top 8% of reviewers for NeurIPS

### Publications and Works (submitted, accepted, or appeared)

*Papers are arranged in reverse chronological order, according to the date they are submitted to*

the arXiv

1. C. Paquette, E. Paquette, B. Adlam, J. Pennington. *Implicit Regularization or Implicit Conditioning? Exact Risk Trajectories of SGD in High Dimensions*. (2022) (accepted to NeurIPS 2022) arXiv: <https://arxiv.org/abs/2206.07252>
2. K. Lee, A.N. Cheng, E. Paquette, C. Paquette. *Trajectory of Mini-Batch Momentum: Batch Size Saturation and Convergence in High-Dimensions*. (2022) (accepted to NeurIPS 2022) arXiv: <https://arxiv.org/pdf/2206.01029.pdf>
3. C. Paquette, E. Paquette, B. Adlam, J. Pennington. *Homogenization of SGD in high-dimensions: Exact dynamics and generalization properties*. (2022) arXiv: <https://arxiv.org/pdf/2205.07069.pdf>
4. L. Cunha, G. Gidel, F. Pedregosa, D. Scieur, C. Paquette. *Only Tails Matter: Average-case Universality and Robustness in the Convex Regime*. Proceedings of the 39<sup>th</sup> International Conference on Machine Learning (ICML), 2022 pdf: <https://proceedings.mlr.press/v162/cunha22a/cunha22a.pdf>
5. C. Paquette, E. Paquette. *Dynamics of Stochastic Momentum Methods on Large-scale, Quadratic Models*. Advances in Neural Information Processing Systems (NeurIPS), 2021 pdf: <https://proceedings.neurips.cc/paper/2021/file/4cf0ed8641cfcbbf46784e620a0316fb-Paper.pdf>
6. C. Paquette, K. Lee, F. Pedregosa, and E. Paquette. *SGD in the Large: Average-case Analysis, Asymptotics, and Step Size Criticality*. 34<sup>th</sup> Annual Conference on Learning Theory (COLT 2021) pdf: <http://proceedings.mlr.press/v134/paquette21a.html>
7. C. Paquette, B. van Merriënboer, E. Paquette, and F. Pedregosa. *Halting time is predictable for large models: A Universality Property and Average-case Analysis*. Found Comput Math (2022) pdf: <https://doi.org/10.1007/s10208-022-09554-y>
8. S. Baghal, C. Paquette, and S.A. Vavasis. *A termination criterion for stochastic gradient for binary classification*. (2020) arXiv: <https://arxiv.org/abs/2003.10312> (submitted)
9. C. Paquette and S.A. Vavasis. *Potential-based analyses of first-order methods for constrained and composite optimization*. (2019) arXiv: <https://arxiv.org/pdf/1903.08497.pdf> (submitted)
10. C. Paquette and K. Scheinberg. *A stochastic line-search method with expected complexity analysis*. SIAM J. Optim. 30 (2020) no. 1, 349-376 <https://doi.org/10.1137/18M1216250>
11. D. Davis, D. Drusvyatskiy, K.J. MacPhee, and C. Paquette. *Subgradient methods for sharp weakly convex functions*. J. Optim. Theory Appl. (179) (2018) no. 3 pgs 962-982 <https://doi.org/10.1007/s10957-018-1372-8>
12. D. Davis, D. Drusvyatskiy, and C. Paquette. *The nonsmooth landscape of phase retrieval*. IMA J. Numer. Anal. 40 (2020) no.4 2652-2695 <https://doi.org/10.1093/imanum/drz031>

13. C. Paquette, H. Lin, D. Drusvyatskiy, J. Mairal, and Z. Harchaoui. *Catalyst Acceleration for Gradient-Based Non-Convex Optimization*. 22nd International Conference on Artificial Intelligence and Statistics (AISTATS 2018)  
<http://proceedings.mlr.press/v84/paquette18a.html>
14. D. Drusvyatskiy and C. Paquette. *Efficiency of minimizing compositions of convex functions and smooth maps*. Math. Program. 178 (2019), no. 1-2, Ser. A, 503-558  
<https://doi.org/10.1007/s10107-018-1311-3>
15. D. Drusvyatskiy and C. Paquette. *Variational analysis of spectral functions simplified*. J. Convex Analysis. 25 (2018) no. 1, 119-134.

## **Expository Writing**

1. C. Paquette and E. Paquette. *High-dimensional Optimization*. (2022) (submitted to SIAG/OPT Views and News)

## **Presentations and Tutorials**

### *Colloquium/Plenary Speaker*

- Conference on the Mathematical Theory of Deep Neural Networks, [DeepMath](#), UC San Diego, CA (November 2022, upcoming)
- [Information Systems Laboratory Colloquium](#), Stanford University, Stanford, CA (October 2022, upcoming)
- Plenary speaker, [GroundedML Workshop](#) at 10<sup>th</sup> International Conference on Learning Representations ICLR 2022, virtual event (April 2022)
- [Courant Institute of Mathematical Sciences Colloquium](#), New York University, New York City, NY (January 2022)
- Mathematics Department Colloquium, [University of California-Davis](#) (virtual), Davis, CA, (January 2022)
- Operations Research and Financial Engineering Colloquium, [Princeton University](#) (virtual), Princeton, NJ (January 2022)
- [Computational and Applied Mathematics \(CAAM\) Colloquium](#) Rice University (in-person), Houston, TX, (December 2021)
- Plenary speaker, [Beyond first-order methods in machine learning systems Workshop](#), International Conference on Machine Learning (ICML), virtual event (July 2021)
- Operations Research Center Seminar, [Sloan School of Management, Massachusetts Institute of Technology \(MIT\)](#), Boston, MA (February 2021)
- [Operations Research and Information Engineering](#) (ORIE) Colloquium, Cornell

University, Ithaca, NY (February 2021)

- Tutte Colloquium, [Combinatorics and Optimization Department](#), University of Waterloo, Waterloo, ON (June 2020)
- [Center for Artificial Intelligence Design \(CAIDA\) \(colloquium\)](#), University of British Columbia, Vancouver, BC (June 2020)
- Math Colloquium, [Ohio State University](#), Columbus, OH (February 2019)
- Applied Math Colloquium, [Brown University](#), Providence, RI (February 2019)
- Mathematics and Statistics Colloquium, [St. Louis University](#), St. Louis, MO (November 2019)

#### *Tutorials*

- *Nonconvex and Nonsmooth Optimization Tutorial*, [East Coast Optimization Meeting](#), George Mason University, Fairfax, VA (April 2022)
- *Average Case Complexity Tutorial*, [Workshop on Optimization under Uncertainty](#), Centre de recherches mathématiques (CRM), Montreal, QC (September 2021)
- *Stochastic Optimization*, Summer School talk for University of Washington's ADSI Summer School on [Foundations of Data Science](#), Seattle, WA (August 2019)

#### *Invited Speaker*

- Foundations of Computational Mathematics, Paris, (June 2023, upcoming)
- [SIAM Conference on Optimization](#), Seattle, WA (June 2023, upcoming)
- Department of Decision Sciences Seminar, [HEC](#), Montreal, QC (December 2022, upcoming)
- Dynamical Systems Seminar, Brown University, Providence, RI (October 2022, upcoming)
- Tea talk, [Quebec Artificial Intelligence Institute \(MILA\)](#), Montreal, QC (September 2022)
- Adrian Lewis' 60<sup>th</sup> Birthday Conference (contributed talk), University of Washington, Seattle, WA (August 2022)
- Stochastic Optimization Session (contributed talk), [International Conference on Continuous Optimization \(ICCOPT 2022\)](#), Lehigh University, Bethlehem, PA (July 2022)
- [Conference on random matrix theory and numerical linear algebra](#) (contributed talk), University of Washington, Seattle, WA (June 2022)
- [Dynamics of Learning and Optimization in Brains and Machines](#), UNIQUE Student Symposium, MILA, Montreal, QC, (June 2022)
- The Mathematics of Machine Learning, [Women and Mathematics](#), Institute for Advanced Study, Princeton, NJ (May 2022)
- Robustness and Resilience in Stochastic Optimization and Statistical Learning: Mathematical Foundations, [Ettore Majorana Foundation and Centre for Scientific Culture](#), Erice, Italy (May 2022)
- Optimization in Data Science (contributed talk), [INFORMS Optimization Society Meeting 2022](#), Greenville, SC (March 2022)

- Optimization and ML Workshop (contributed talk), [Canadian Mathematical Society \(CMS\)](#), Montreal, QC (December 2021)
- [OR/Optimization Seminar](#), UBC-Okanagan and Simon Fraser University, Burnaby, BC (December 2021)
- [Machine Learning Advances and Applications Seminar](#), Fields Institute for Research in Mathematical Sciences, Toronto, ON (November 2021)
- Methods for Large-Scale, Nonlinear Stochastic Optimization Session (contributed talk), [SIAM Conference on Optimization](#), Spokane, WA (July 2021)
- [MILA TechAide AI Conference](#) (invited talk), Montreal, QC (May 2021)
- Minisymposium on Random matrices and numerical linear algebra (contributed talk), [SIAM Conference on Applied Linear Algebra](#), (May 2021)
- [Numerical Analysis Seminar](#) (invited talk), Applied Mathematics, University of Washington, Seattle, WA (April 2021)
- Applied Mathematics Seminar (invited talk), [Applied Mathematics, McGill University](#), Montreal, QC (January 2021)
- Optimization and ML Workshop (contributed talk), [Canadian Mathematical Society \(CMS\)](#), Montreal, QC (December 2020)
- UW Machine Learning Seminar (invited talk), [Paul G. Allen School of Computer Science](#), University of Washington, Seattle, WA (November 2020)
- [Soup and Science](#) (contributed talk), McGill University, Montreal, QC (September 2020)
- Conference on Optimization, [Fields Institute for Research in Mathematical Science](#), Toronto, ON (November 2019)
- Applied Math Seminar, [McGill University](#), Montreal, QC (February 2019)
- Applied Math and Analysis Seminar, [Duke University](#), Durham, NC (January 2019)
- [Google Brain Tea Talk](#), Montreal, QC (January 2019)
- Young Researcher Workshop, [Operations Research and Information Engineering \(ORIE\)](#), Cornell University, Ithaca, NY (October 2018)
- [DIMACS/NSF-TRIPODS conference](#), Lehigh University, Bethlehem, PA (July 2018)
- [INFORMS annual meeting](#), Session talk, Houston, TX (October 2017)
- Optimization Seminar, [Lehigh University](#), Bethlehem, PA (September 2017)
- [SIAM-optimization](#), Session talk, Vancouver, BC (May 2017)
- Optimization and Statistical Learning, Les Houches (April 2017)
- [West Coast Optimization Meeting](#), University of British Columbia (September 2016)

## **Students**

### *Post-docs*

- Yakov Vaisbourd (2020-present)

### *Master Students*

- Andrew Cheng (McGill), Sept. 2021-present
- Hugo Latourelle-Vigeant (McGill), May 2022-present

### *Undergraduate Students*

- Nicolas Fertout (McGill), summer project, 2021 (now M.Sc. student Stanford, 2022)
- Hugo Latourelle-Vigeant (McGill), summer project, 2021 (now M.Sc. student McGill, 2021)
- Vincent Savignac (McGill), summer project, 2021
- Ria Stevens (McGill), summer project, 2021 (now PhD student Rice, 2022)



- Jaijun Yu (McGill), summer project, 2021 (now M.Sc. student Oxford, 2022)

## Service and Extra Curricular Activities

### Conference and Tutorial Organizing:

- *Optimization for Machine Learning Workshop (NeurIPS 2022): **Program Chair***
  - In-person event, 06/2022-12/2022
  - Website: <https://opt-ml.org/>
  - Acceptance rate: 60/120 workshops accepted to NeurIPS
- *Optimization for Machine Learning Workshop (NeurIPS 2021): **Program Chair***
  - Virtual event, 06/2021-12/2021
  - Website: <https://opt-ml.org/>
  - Arranged and scheduled speakers, reviewed papers for a proceeding, and set-up entire 12-hour virtual event, ~400 participants in the conference with 8 plenary speakers and ~60 paper submissions
  - Acceptance rate: 60/120 workshops accepted to NeurIPS
- *Montreal AI Symposium: **Program Chair***
  - Hybrid event, 06/2021-10/2021
  - Website: <http://montrealaisymposium.com/>
  - 1-day event that brings together researchers from the greater Montreal Area in machine learning and artificial intelligence
  - Arranged for sponsors and speakers
  - Hybrid event: both in-person and virtual components
  - ~100 paper submissions and 7 plenary speakers; attendance ~300
- *Random Matrix Theory and Machine Learning Tutorial (ICML 2021): **Organizer***
  - Virtual event, 01/2021-06/2021
  - Website: <https://random-matrix-learning.github.io/>
  - 3-hour introductory tutorial on the usage of random matrix theory techniques in machine learning; part of the ICML conference
  - Acceptance rate: 30/60 tutorials accepted to ICML
- *Optimization for Machine Learning Workshop (NeurIPS 2020): **Program Chair***
  - Virtual event, 06/2020-12/2020
  - Website: <https://opt-ml.org/>
  - Arranged and scheduled speakers, reviewed papers for a proceeding, and set-up entire 12-hour virtual event, expect ~250 participants with 9 plenary speakers and ~100 paper submissions
  - Acceptance rate: 60/120 workshops accepted to NeurIPS

### Seminar Organizing:

- *Random Matrix Theory, Machine Learning, and Optimization (RMT+ML+OPT) Graduate Seminar: Co-Lead Organizer*
  - McGill University, Montreal, QC; 09/2021-present
  - **Website:** <https://elliotpauquette.github.io/rmtmloptseminar.html>
  - Co-created by Elliot Paquette

- Created a weekly seminar for undergraduate and graduate students to present papers and research ideas in the field of mathematics of Machine Learning
- *Continuous Optimization Seminar: Lead Organizer*
  - University of Waterloo, Waterloo, ON; 09/2018-06/2019
  - Arranged and scheduled student and faculty speakers from multiple departments (computer science, electrical engineering, statistics, mathematics, and applied math)
- *NSF TRIPODS/DIMACS: Organizer*
  - Lehigh University, Bethlehem PA; 08/2018
  - Arranged and scheduled speakers for a 3-day conference as part of the NSF TRIPODS grant
- *NSF TRIPODS summer school: Organizer*
  - Lehigh University, Bethlehem, PA; 08/2018
  - Arranged and scheduled 40 students to participate in a 3-day summer school that covers optimization in machine learning, TensorFlow, and online learning
- *Opt-ML Seminar: Organizer*
  - Lehigh University, Bethlehem, Pa 01/2018-06/2018
  - Arranged and scheduled student and faculty speakers from multiple departments (computer science, electrical engineering, statistics, mathematics, and applied math)
- *Trends in Optimization Seminar: Organizer*
  - University of Washington, Seattle; 01/2018-06/2018
  - Arranged and scheduled student and faculty speakers from multiple departments (computer science, electrical engineering, statistics, mathematics, and applied math)

### **Mini symposium Organizing:**

- *Machine Learning and Optimization mini symposium (Canadian Applied and Industrial Mathematics, CAIMS annual meeting): Lead Organizer*
  - Hybrid event, 06/2022
  - Website: <https://caims.ca/>
  - Arranged and scheduled speakers 4 speakers

### **Departmental committees:**

- Computing and Equipment (McGill University), **chair**, June 2021-present
- Computing and Equipment (McGill University), member, August 2020-June 2021;

### **Diversity, Equity, and Inclusion Activities:**

- Co-lead the Young Researchers Seminar, [Women and Mathematics – The Mathematics of Machine Learning](#), **Institute for Advanced Study**, Princeton, NJ, May 2022: Organized 10 young women (post-docs and assistant professors) to give short talks on their research in machine learning
- Optimization Journal Club, [Eastern Europe ML Summer School](#), July 2022: Ran and organized student presenters on optimization papers; led discussions; talked about career and research in optimization



- CIFAR/MILA Career Panel, *CIFAR Deep Learning and Reinforcement Learning Summer School*, August 2020: Served as a panelist detailing my career path and experiences
- UW AWM Chapter: Secretary and Original member  
University of Washington, Seattle, 2015-2017
  - Part of the leadership group that established the University of Washington's first AWM chapter
  - Chief organizer of a campus outreach tutoring program to encourage undergraduate

**Reviewing articles:** NeurIPS reviewer (2018, 2020, 2021, 2022); Math. Programming; SIAM J. of Optimization; J. of Machine Learning Research; J. for Optimization Theory; J. of Convex Analysis