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-September 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 and Awards

1. FRQNT New university researchers 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's Rising Star in AI, Winter 2022 (Reach Magazine)
5. CIFAR AI Chair, MILA, PI ($500,000; 2020-2025,)
6. NSF Postdoctoral fellowship (July 2018-July 2019)
7. Tanzi-Egerton Fellowship Award (2016)
8. Excellence in Teaching Award (UW Math department) (2012)

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) arXiv:

2. K. Lee, A.N. Cheng, E. Paquette, C.Paquette. *Trajectory of Mini-Batch Momentum: Batch Size Saturation and Convergence in High-Dimensions.* (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, C. Paquette, D. Scieur. *Only Tails Matter: Average-case Universality and Robustness in the Convex Regime.* (accepted to ICML, 2022)

5. C. Paquette, E. Paquette. *Dynamics of Stochastic Momentum Methods on Large-scale, Quadratic Models.* (2021) arXiv: https://arxiv.org/pdf/2106.03696.pdf (to appear at NeurIPS 2021)

6. C. Paquette, K. Lee, F. Pedregosa, E. Paquette. *SGD in the Large: Average-case Analysis, Asymptotics, and Stepsize Criticality.* 34th Annual Conference on Learning Theory (COLT 2021) pdf: http://proceedings.mlr.press/v134/paquette21a.html

7. C. Paquette, B. van Merrienboer, F. Pedregosa, and E. Paquette. *Halting time is predictable for large models: A Universality Property and Average-case Analysis.* (2020) arXiv: https://arxiv.org/abs/2006.04299 (to appear in *Found. Comput. Math.*)

8. S. Baghal, C. Paquette, and SA Vavasis. *A termination criterion for stochastic gradient for binary classification.* (2020) arXiv: https://arxiv.org/abs/2003.10312 (submitted)

9. C. Paquette and SA.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.

Presentations and Tutorials

Colloquium/Plenary Speaker

- Optimization in the Large, plenary speaker, GroundedML Workshop at 10th International Conference on Learning Representations ICLR 2022, virtual event (April 2022)
- Optimization in the Large, Courant Institute of Mathematical Sciences Colloquium, New York University, New York City, NY (January 2022)
- Optimization in the Large, Math Department Colloquium, University of California-Davis (virtual), Davis, CA, (January 2022)
- Optimization in the Large, Operations Research and Financial Engineering Colloquium, Princeton University (virtual), Princeton, NJ (January 2022)
- Optimization in the Large, Computational and Applied Mathematics (CAAM) Colloquium Rice University (in-person), Houston, TX, (December 2021)
- Beyond first-order methods in machine learning systems Workshop (plenary talk), 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 mathematiques (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

- Adrian Lewis' 60th 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)
- 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)
- 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
- Hugo Latourelle-Vigeant (McGill), summer project, 2021
- Vincent Savignac (McGill), summer project, 2021
- Ria Stevens (McGill), summer project, 2021
- Jaijun Yu (McGill), summer project, 2021

Service and Extra Curricular Activities

Conference and Tutorial Organizing:

- *Optimization and 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 participates 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 and 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 participates with 9 plenary speakers and ~100 paper submissions
  - Acceptance rate: 60/120 workshops accepted to NeurIPS

Seminar Organizing:

- *Random matrix theory, Optimization, and Machine Learning: Lead Organizer*
    - McGill University, Montreal, QC; 09/2021-present
    - 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
    - In Fall term 2021, 4 graduate students; 2 undergraduates; 1 post-doc speak
- *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, Pal 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:

- **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