Aaron Mishkin

amishkin@cs.stanford.edu www.cs.stanford.edu/~amishkin/

Education

Current – 2020	**PhD in Computer Science**, Stanford University *Optimization for Machine Learning* Advisor: Dr. Mert Pilanci
2020 – 2018	**MSc in Computer Science**, University of British Columbia Thesis: *Interpolation, Growth Conditions, and Stochastic Gradient Descent* Advisor: Dr. Mark Schmidt
2018 – 2013	**BSc in Computer Science (Honors)**, University of British Columbia Honors Thesis: *Limited Memory Methods for Variational Inference* Honors Advisor: Dr. David Poole

Publications

Preprints

Aaron Mishkin, Alberto Bietti, Robert Gower. "Level Set Teleportation: An Optimization Perspective". [arXiv]

Amrutha Varshini Ramesh*, **Aaron Mishkin***, Mark Schmidt, Yihan Zhou, Jonathan Wilder Lavington, and Jennifer She. "Analyzing and Improving Greedy 2-Coordinate Updates for Equality-Constrained Optimization via Steepest Descent in the 1-Norm." [arXiv]

Emi Zeger, Yifei Wang, **Aaron Mishkin**, Tolga Ergen, Emmanuel Candès, and Mert Pilanci. "A Library of Mirrors: Deep Neural Nets in Low Dimensions are Convex Lasso Models with Reflection Features." [arXiv]

Refereed Papers

Aaron Mishkin*, Ahmed Khaled*, Yuanhao Wang, Aaron Defazio, Robert Gower. "Directional Smoothness and Gradient Methods: Convergence and Adaptivity" *Neural Information Processing Systems (NeurIPS)*, 2024. [arXiv]

Aaron Mishkin, Mert Pilanci. "Optimal Sets and Solution Paths of ReLU Networks" *International Conference on Machine Learning (ICML)*, 2023. [arXiv]

Aaron Mishkin, Arda Sahiner, Mert Pilanci. "Fast Convex Optimization for Two-Layer ReLU Networks: Equivalent Model Classes and Cone Decompositions" *International Conference on Machine Learning (ICML)*, 2022. [arXiv]

Sharan Vaswani, **Aaron Mishkin**, Issam Laradji, Mark Schmidt, Gauthier Gidel, and Simon Lacoste-Julien. "Painless Stochastic Gradient: Interpolation, Line-Search, and Convergence Rates." *Neural Information Processing Systems (NeurIPS)*, 2019. [arXiv]

Aaron Mishkin, Frederik Kunstner, Didrik Nielsen, Mark Schmidt, and Mohammad Emtiyaz Khan. "SLANG: Fast Structured Covariance Approximations for Bayesian Deep Learning with Natural-Gradient", *Neural Information Processing Systems (NeurIPS)*, 2018. [arXiv]

Book Chapters

Kevin P. Murphy, Frederik Kunstner, Si Yi Meng, **Aaron Mishkin**, Sharan Vaswani, and Mark Schmidt. **Chapter 8: Optimization** in *Probabilistic Machine Learning: An Introduction*. MIT press, 2022.

Workshop Papers

Aaron Mishkin*, Ahmed Khaled*, Aaron Defazio, Robert Gower. "A Novel Analysis of Gradient Descent Under Directional Smoothness" *NeurIPS OPT2023*, 2023. [pdf]

Aaron Mishkin, Alberto Bietti, Robert Gower. "Level Set Teleportation: the Good, the Bad, and the Ugly" *NeurIPS OPT2023*, 2023. [pdf]

Aaron Mishkin, Mert Pilanci. "The Solution Path of the Group Lasso" *NeurIPS OPT2022*, 2022. [pdf]

Amrutha Varshini Ramesh, **Aaron Mishkin**, Mark Schmidt. "Fast Convergence of Greedy 2-Coordinate Updates for Optimizing with an Equality Constraint" *NeurIPS OPT2022*, 2022. [pdf]

Sharan Vaswani, Reza Babanezhad, Jose Gallego, **Aaron Mishkin**, Simon Lacoste-Julien, and Nicolas Le Roux. "To Each Optimizer a Norm, to Each Norm its Generalization." *NeurIPS OPT2020*, 2020. [arXiv]

Aaron Mishkin. "Web ValueCharts: Analyzing Individual and Group Preferences with Interactive, Web-based Visualizations", Extended Abstract in *Review of Undergraduate Computer Science*, 2017. [pdf]

* Denotes equal contribution.

Experience

July - Dec 2024	**Visiting PhD Student**, SIERRA Team, Inria Advisor: Dr. Francis Bach Studying the role of depth in global optimization of non-convex neural networks.
June - Aug 2023	**Predoctoral Researcher**, CCM, Flatiron Institute Advisors: Dr. Robert Gower and Dr. Alberto Bietti Proved new convergence bounds for gradient descent under a novel directional smoothness condition and developed practical algorithms for level set teleportation.
May - Aug 2019	**Applied Science Intern**, Amazon Development Center Germany GmbH Advisors: Dr. Cédric Archambeau and Dr. Matthias Seeger Investigated meta-learning approaches to cold-start active learning. Implemented foMAML, prototypical networks, and conditional neural adaptive processes (CNAPS).

Jan - Jun 2018 | **Research Intern**, RIKEN Center for Advanced Intelligence Project (AIP)
Advisor: Dr. Emtiyaz Khan
Worked with a diverse team on SLANG, an approximate natural gradient method for Gaussian variational inference in neural networks (published at NeurIPS 2018).

May - Aug 2016/17 | **Undergraduate Research Assistant**, UBC
Advisors: Dr. David Poole and Dr. Giuseppe Carenini
Received two undergraduate research awards from NSERC to investigate information visualizations for preference elicitation. Developed Web ValueCharts.

May - Dec 2015 | **Software Engineering Co-op Student**, MacDonald, Dettwiler and Associates
Acted as a full member of a small team to develop a client for ordering satellite imagery. Implemented the map interface for the RADARSAT Constellation Mission.

Teaching

Apr - Jun 2022-2024 | **TA**, EE 364B: Convex Optimization II (Stanford University)
Prepared homework and exam questions, held weekly office hours, and supervised assignment graders for a graduate-level class on convex optimization algorithms.

Jun 2018 | **TA**, Data Science Summer School (DS3) 2018
Prepared and delivered exercises on stochastic variational inference for graduate students attending a two day tutorial on approximate Bayesian inference.

Sep - Dec 2017 | **TA**, CPSC 340: Machine Learning (UBC)
Gave tutorials on diverse topics in machine learning, including regularization, convexity, and MAP estimation. Held weekly office hours for students, marked assignments and invigilated exams.

Jan - May 2015 | **TA**, CPSC 210: Software Construction (UBC)
Supervised laboratories for a software engineering course on object-oriented programming and design in the Java programming language.

Sep - Dec 2014 | **TA**, CPSC 110: Computation, Programs and Programming (UBC)
Taught the fundamental concepts of functional programming in a Lisp-family language during weekly labs.

Awards

PhD

2024 | **Visiting Student Research Fellowship**
France-Stanford Center for Interdisciplinary Studies
Awarded support research visit to SIERRA team, Inria.

2020 | **Graduate Research Fellowship (GRF)**
National Sciences Foundation (NSF)
Five-year fellowship for PhD students in STEM disciplines.

2020 | **NSERC Postgraduate Scholarships-Doctoral Program (PGS D)**
Natural Sciences and Engineering Research Council of Canada
Three-year fellowship for PhD students studying in Canada or abroad.

2020 | **Canada Graduate Scholarships-Doctoral Program (CGS D)** (Declined)
Natural Sciences and Engineering Research Council of Canada
Three-year fellowship for PhD students studying in Canada.

MSc

2019 | **Huawei Graduate Scholarship**
Huawei and Department of Computer Science, UBC
Competitive scholarship for MSc students entering their second year.

2018 | **Computer Science Merit Scholarship**
Department of Computer Science, UBC
Merit-based scholarship for incoming international and domestic students.

2018 | **Canada Graduate Scholarships-Master's Program (CGSM)**
Natural Sciences and Engineering Research Council of Canada
National fellowship awarded to up to 2,500 students annually.

BSc

2018 | **Academic Award of Excellence (Honors)**
Department of Computer Science, UBC
Awarded to the graduating student with the highest standing in the BSc (Honors) in Computer Science.

2018 | **Markus Meister Memorial Prize**
Department of Computer Science, UBC
Awarded to the graduating student with the highest standing in the final year of the BSc in Computer Science.

2017 | **D. F. MacKenzie Scholarship**
UBC

2016, 2017 | **Undergraduate Student Research Award (USRA)**
Natural Sciences and Engineering Research Council of Canada

2016, 2017 | **Computer Science Scholarship**
Department of Computer Science, UBC

2016, 2017 | **Trek Excellence Scholarship for Continuing Students**
UBC
Awarded yearly to students in the top 5% of their undergraduate year, faculty, and school.

2016 | **J Fred Muir Memorial Scholarship**
UBC

General

2018 | **Travel Award for NeurIPS 2018**
Neural Information Processing Systems (NeurIPS) Foundation

2017 | **Best Demo**
UBC HCI Designing for People Year-end Event
For: Web ValueCharts

Academic Service

I review for ICML, NeurIPS, AISTATS, ICLR, and TMLR as well as JMLR, SIMODS, and several other journals. I was a top reviewer for ICML 2024, NeurIPS 2023, ICLR 2022, NeurIPS 2022, ICML 2021, and NeurIPS 2020. I was an expert reviewer for ICML 2021 and am an expert reviewer for TMLR.

I volunteer for the Stanford student application support program (SASP), and am a mentor for the Stanford CS undergraduate mentorship program and CERIO.