

Aaron Berk

(905) 906 - 2821

aberk@math.ubc.ca

<http://www.math.ubc.ca/~aberk>

Aaron Berk, Dept. Mathematics
University of British Columbia
Rm 121, 1984 Mathematics Road
Vancouver, BC, Canada V6T 1Z2

Education

University of British Columbia

Ph.D. Candidate — Applied Mathematics

Vancouver, BC

2015 – Present

- Principal Supervisors: [Dr. Özgür Yilmaz](#) and [Dr. Yaniv Plan](#)
- I am also being supervised by [Dr. Ipek Oruc](#)
- Research areas: signal & image processing, compressed sensing, machine learning
- Awarded Four-Year Fellowship (institutional)
- Awarded NSERC CGS-D (national)
- Member of IAM Student Committee and Mathematics Grad Student Committee

University of Toronto

M.Sc. Mathematics

Toronto, ON

2013 – 2014

- [On multiscale analysis and PDE methods on graphs in image processing](#)
- Supervisor: Dr. Adrian Nachman
- 90% cumulative average
- Math rep to UT Graduate Students Union

McMaster University

B.Sc. Hon. Maths & Stats

Hamilton, ON

2009 – 2013

- Dean's Honours List (2009 - 2013)
- The McMaster Honour Award, Level 3 (2009)
- The University (Senate) Scholarship (2010, 2012)
- NSERC USRA (2012, 2013)
- 11.5 cumulative average (3.95 GPA)

Research experience

Graduate Researcher — Compressed Sensing & Machine Learning

Sept 2015 – Present

Drs. Özgür Yilmaz, Yaniv Plan & Ipek Oruc, UBC

Vancouver, BC

- Researching convex methods for compression and recovery of structured high-dimensional data
- Researching deep learning methods for medical imaging
- Using methods from geometric functional analysis, machine learning, high-dimensional probability & image processing

Data Scientist — Feature Selection & Signal Processing

Oct 2016 – Feb 2017

Andrea Palmer, Paul Fijal

Awake Labs, Vancouver, BC

- Mitacs Accelerate internship
- Researching feature selection methods for low-rank high-dimensional signal classification
- Python implementation of geometric multi-scale methods for data-adaptive signal processing

Graduate Researcher — Medical Imaging Algorithms

May – Aug 2014

Supervisor: Dr. Adrian Nachman, University of Toronto

Toronto, ON

- Researched variational methods in image processing to develop fast computational methods for applications in medical imaging (*cf.* final document above)
- Relied heavily on wavelet methods, numerical methods for PDE (gradient descent, spectral methods, convex splitting), eigenvalue problems (the Nyström Extension), matrix conditioning

Undergraduate Research Assistant — Computational Fluid Dynamics May – Aug 2013
Supervisor: Dr. Nicholas Kevlahan, McMaster University Hamilton, ON

- Researched adaptive wavelet methods for solving PDEs on irregular and spherical domains; examined efficacy of these methods in solving shallow water equations subject to realistic bottom bathymetry and coastline data
- Wrote a software library in MATLAB to process and visualize geophysical images and data, using level set methods to morphologically alter real data and compute its geometric properties

Undergraduate Research Assistant — Computational Stats, Math Ecology May – Aug 2012
Supervisor: Dr. Benjamin Bolker, McMaster University Hamilton, ON

- Optimized and analyzed GLM models for heteroskedastic pine seed and pine seedling spatial population distributions to determine the relationship between the seed, seedling and environmental autocorrelation functions (using `nlme`, `stats`, `RandomFields` in R)
- Created protocols in R to semi-autonomously retrieve, analyze and visualize large-scale bibliometric data

Summer Research Assistant — Computational Mathematical Biology May – Aug 2011
Supervisor: Dr. Diamandis, SLRI, Mt. Sinai Hospital Toronto, ON

- Developed and simulated a mathematical model to simulate the effect of chemotactic enzyme gradients on tumour morphology and tumour cell movement (using R) (Karagiannis, *et al.*, 2013)
- Assisted lab members with data processing and statistical analysis using Microsoft Excel and R

Publications

- [1] A. Berk, Y. Plan, and O. Yilmaz. Parameter instability regimes in sparse proximal denoising programs. In *SampTA*, 2019.
- [2] A. Berk, Y. Plan, and O. Yilmaz. Sensitivity of ℓ_1 minimization to parameter choice. *Information and Inference (accepted)*, 2020. [arXiv:1810.11968](https://arxiv.org/abs/1810.11968).
- [3] G. S. Karagiannis, A. Berk, A. Dimitromanolakis, and E. P. Diamandis. Enrichment map profiling of the cancer invasion front suggests regulation of colorectal cancer progression by the bone morphogenetic protein antagonist, gremlin-1. *Molecular oncology*, 7(4):826–839, 2013.

Selected Talks

PIMS CRG Summer School Simon Fraser University
PIMS CRG Summer School: Deep Learning for Computational Mathematics July 2019

- Invited talk on deep learning applications to medical imaging in ophthalmology.

SampTA 2019 Université Bordeaux
13th International Conference on Sampling Theory and Applications July 2019

- Research talk on sensitivity of ℓ_1 minimization to parameter choice.

UBC Department of Ophthalmology & Visual Sciences VGH/UBC Eye Care Centre
35th Annual O&VS Research Day April 2019

- Research talk on a deep learning approach to understanding retinal fundus images.
- Winner of Graduate Student Presentation Award.

Computational Math Seminar Simon Fraser University
SFU Computational Math Seminar March 2019

- Invited research talk on parameter instability in sparse proximal denoising programs.

Banff International Research Station Banff International Research Station
Intersection of Information Theory and Signal Processing October 2018

- Invited research talk on parameter instability in proximal denoising programs.

- PIMS High Dimensional Data Analysis** University of British Columbia
Mathematical Foundations of Data Science August 2018
- Invited research talk on parameter instability in compressed sensing programs.
- International Matheon Conference** Technische Universität Berlin
Compressed Sensing and its Applications December 2017
- Contributed research poster on parameter instability in compressed sensing programs.
- IAM Student Committee** University of British Columbia
Graduate Student Seminar October 2015
- Invited talk on wavelets and wavelet de-noising
- Canadian Mathematical Society** Université de Montréal
Canadian Undergraduate Mathematics Conference July 2013
- Contributed talk presenting an introduction to wavelet theory, and their application to PDE modelling.
- SLRI Research Training Centre** Samuel Lunenfeld Research Institute
Summer Research Symposium Aug 2011
- Invited poster on mathematical modelling of chemotactic enzyme gradients at a showcase of SLRI summer research projects

Recent and upcoming workshops

- Optimization for Data Science Summer School** UBC, Vancouver BC
Organized by: PIMS and UBC IAM July 2018
- Representations of High Dimensional Data Summer Graduate School** MSRI, Berkeley CA
Deanna Needell (UCLA) & Blake Hunter (Microsoft) July 2018
- BC Data Science Workshop** UBC, Vancouver BC
Organized by: PIMS and UBC IAM June 2018
- Data Science Workshop for Applied Mathematicians** UBC, Vancouver BC
Organized by: UBC Institute of Applied Mathematics August 2017
- Mathematical Modelling in Industry Workshop** UBC, Vancouver BC
Organized by: PIMS August 2016

Selected honours & awards

- Margaret L. Adamson Award** UBC Ophthalmology and Visual Sciences
 \$ 2 000 December 2019
- Acclerate internship** Mitacs, Awake Labs
 \$15 000 October 2016
- Canada Graduate Scholarship—Doctoral (CGS-D)** NSERC, UBC
 \$35 000 *per annum* September 2016
- Four Year Fellowship** University of British Columbia
 \$18 000 *per annum* Spring 2015
- Canada Graduate Scholarship (Master’s level)** NSERC, University of Toronto
 \$17 500 [declined] Fall 2014
- Blythe Fellowship** University of Toronto
 \$16 500 Fall 2013
- Ontario Graduate Scholarship** McMaster University
 \$15 000 [declined] Spring 2013

Teaching experience

Masters of Data Science

University of British Columbia

Teaching Assistant

Sept 2017 – Present

- UBC's Master of Data Science program is a year-long intensive, cut into 6 blocks of courses and a capstone project.
- 2017: Descriptive Statistics and Probability for Data Science, Communication and Argumentation, Data Wrangling, Supervised Learning I, Feature and Model Selection, Statistical Inference and Computation II, Experimentation and Causal Inference
- 2018: Communication & Argumentation, Data Wrangling, Databases and Data Retrieval, Unsupervised Learning, Spatial & Temporal Models, Web and Cloud Computing

Multivariable and Vector Calculus

University of British Columbia

Teaching Assistant

Jan 2015 – Apr 2015

- Second year calculus for electrical engineers; co-syllabus with electrical engineering electrodynamics course
- Graded students' midterms, biweekly assignments; required knowledge of electrodynamics, multivariable calculus, linear algebra

Math Learning Centre

University of British Columbia

Teaching Assistant

Sept 2015 – Dec 2015

- Quick-help TA: given a strict two minute duration in which to respond to student questions. Peak hours popularity demand high energy, on-the-spot ingenuity, concise clarity
- TA in-charge: ensure TAs evenly distribute among students; collect regular data on number of students, TAs; help students when other TAs are indisposed.
- TA: give hints in response to student questions; create novel explanations for class-learned concepts

Biology, Models and Mathematics

University of Toronto

Teaching Assistant

Sept 2013– Apr 2014

- First year math course for Biology students; teaches calculus, model design and basic methods for thinking about experimental design and interpretation, in a way that is relevant to Biology students
- Graded students' weekly assignments and provided feedback to students instructor
- Held two weekly hour-long office hours, where students inquired about course material, assignments; required information be conveyed fluently to confused students, and in a way that would be retained, valued

Engineering Mathematics IV

McMaster University

Undergraduate Teaching Assistant

Jan – Apr 2013

Jul – Aug 2012

- Second-year second-term Engineering Mathematics course
- Graded students' midterms, weekly lab assignments; Required knowledge of vector calculus, Fourier series, linear algebra, graphic visualization and MATLAB
- Led two twice-weekly labs to review course content; used slides I created in L^AT_EX
- Responded to students' questions via e-mail, during office hours; questions pertaining to concept, question clarification required efficacious communication

Calculus for Math and Stats I

McMaster University

Undergraduate Teaching Assistant

Sept – Dec 2012

- Designed, conducted weekly one-hour tutorial; supervised in-tutorial quizzes
- Prepared creative, rigorous examples to stimulate students' interest, develop intuition and mathematical insight
- Answered students questions via e-mail or in the Math Help Centre

Undergraduate mathematics

Private Tutor

Ontario, Canada

Jan 2012–Present

- Tutor for calculus, statistics, differential equations, computer science, complex analysis
- Create study curriculum tailored to student's needs
- Experience with language barriers, mature students, students with disabilities and destination-not-the-journey type students

Service

Mathematics Host

Future Science Leaders

January 2019 – Feb 2019

Science World, Vancouver BC

- Outreach program for engaged, highly motivated high school students interested in STEM fields.

Workshop Organizer and TA

Brian Wetton

Jan 2018 – June 2018

UBC IAM, Vancouver BC

- Organizing the [BC Data Science Workshop](#) for June 2018

Convener

BC Data Colloquium

Jan 2017 – Aug 2018

UBC IAM, UBC DSI, PIMS, CANSSI

- Organizing speakers for the monthly BC Data colloquium
- Previous and upcoming talks available at [bcdata.ca](#)

Workshop Organizer and TA

Brian Wetton

Jan 2017 – Aug 2017

UBC IAM, Vancouver BC

- Organizing the [IAM Data Science Workshop](#) for August 2017

CMS Student Committee (STUDC)

Co-Chair, Student Director

Canadian Mathematical Society

June 2015 – Present

- Coordinate and direct operations of the CMS student committee and its members
- Manage applications for conference funding
- Manage Budgetary responsibilities
- Communicate with Canadian math students on important issues as they relate to STUDC

CMS Student Committee (STUDC)

Webmaster

Canadian Mathematical Society

July 2013 – Present

- Maintain and update the website affiliated with the CMS Student Committee (STUDC)
- Leading the re-design of the website to be more user-friendly, visually appealing to students

Mathematics Graduate Student Association

Graduate Student Union Course Representative

University of Toronto

Sept 2013 – August 2014

- Responsible for submitting grant applications to the Graduate Student Association, and for communication between these organizations
- Effective communication skills required during General Council meetings to raise, discuss important issues on behalf of the MGSA
- Responsible for communication to graduate students in math on the issues facing all graduate students and administration university-wide

Math Mentorship Program

Mentor

University of Toronto

January – April 2014

- Create and supervise a research project, the calibre of which is appropriate for a high-achieving high school student
- Meet regularly with the students to discuss progress and obstacles
- Project discussed aspects of linear algebra, Fourier series and signal theory (*cf.* [project webpage](#))

Engineering and Science Olympics

Volunteer Co-ordinator

McMaster University

Oct. 2012

Oct. 2011

- Organized students and volunteers in a youth-directed competition for scholarship prizes, promoting enjoyment of and fluency in mathematics
- Conducted and judged individual competition trials, participated in by avid and high-achieving high school students of the Greater Toronto Area and Halton Region

Relevant skills

- Programming and Markup Languages
 - **Fluent:** Python, R, MATLAB, L^AT_EX, HTML, CSS, Markdown
 - **Intermediate:** Processing, Java, Unix bash, C++, MySQL
 - **Beginner:** Lisp, Ruby, elisp, Javascript (Node, Meteor, Angular), PHP, sed, awk
- Software
 - **Expert:** Microsoft Word, Adobe Flash Pro 8, Adobe Flash CS3, RStudio, knitr
 - **Intermediate:** emacs, Microsoft Excel, Access, Maple, Adobe Photoshop CS3, Mathematica
- Noteworthy
 - Avid nature lover (hiking, climbing, camping, scuba diving, *etc.*), musician (guitar, piano), circus enthusiast and vegan cook