

Aaron Berk

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Education

University of British Columbia

Vancouver, BC

Ph.D. Candidate — Applied Mathematics

Sept. 2015 –

- Supervisors: [Dr. Özgür Yilmaz](#) and [Dr. Yaniv Plan](#)
- 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

Toronto, ON

M.Sc. Mathematics

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

Hamilton, ON

B.Sc. Hon. Maths & Stats

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

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 — Compressed Sensing

Sept 2015 – Present

Drs. Özgür Yilmaz & Yaniv Plan, UBC

Vancouver, BC

- Researching convex methods for compression and recovery of structured high-dimensional data
- Researching best-basis/feature selection using non-linear data-adaptive dictionaries in high dimensions
- Using methods from geometric functional analysis, high-dimensional probability & image 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 for sparse proximal denoising programs. *arXiv preprint [arXiv:1810.11968](https://arxiv.org/abs/1810.11968)*, 2018.
- [2] A. Berk, Y. Plan, and O. Yilmaz. Parameter instability regimes in sparse proximal denoising programs. In *IEEE ICASSP 2019 (submitted)*, 2018.
- [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 conference presentations

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

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

PIMS High Dimensional Data Analysis Vancouver, BC
Mathematical Foundations of Data Science August 2018

- Invited research talk on parameter instability in compressed sensing programs.

International Matheon Conference Berlin, DE
Compressed Sensing and its Applications December 2017

- Contributed research poster on parameter instability in compressed sensing programs.

IAM Student Committee Vancouver, BC
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

Summer Research Symposium

Samuel Lunenfeld Research Institute

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

Organized by: PIMS and UBC IAM

UBC, Vancouver BC

July 2018

Representations of High Dimensional Data Summer Graduate School

Deanna Needell (UCLA) & Blake Hunter (Microsoft)

MSRI, Berkeley CA

July 2018

BC Data Science Workshop

Organized by: PIMS and UBC IAM

UBC, Vancouver BC

June 2018

Data Science Workshop for Applied Mathematicians

Organized by: UBC Institute of Applied Mathematics

UBC, Vancouver BC

August 2017

Mathematical Modelling in Industry Workshop

Organized by: PIMS

UBC, Vancouver BC

August 2016

Selected honours & awards

Accelerate internship

\$ 15 000

Mitacs, Awake Labs

October 2016

Canada Graduate Scholarship—Doctoral (CGS-D)

\$ 35 000 *per annum*

NSERC, UBC

September 2016

Four Year Fellowship

\$ 18 000 *per annum*

University of British Columbia

Spring 2015

Canada Graduate Scholarship (Master's level)

\$ 17 500 [declined]

NSERC, University of Toronto

Fall 2014

Blythe Fellowship

\$ 16 500

University of Toronto

Fall 2013

Ontario Graduate Scholarship

\$ 15 000 [declined]

McMaster University

Spring 2013

Teaching experience

Masters of Data Science

Teaching Assistant

University of British Columbia

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.
- TA for: 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

Multivariable and Vector Calculus

Teaching Assistant

University of British Columbia

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

Ontario, Canada

Private Tutor

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

Workshop Organizer and TA

Jan 2018 – June 2018

Brian Wetton

UBC IAM, Vancouver BC

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

Convener

Jan 2017 – Aug 2018

BC Data Colloquium

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