

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, 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, 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. [arXiv:1810.11968](https://arxiv.org/abs/1810.11968), 2019.
- [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

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.

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

Accelerate 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

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

| | |
|--|--------------------------------|
| Mathematics Host | January 2019 – Feb 2019 |
| <i>Future Science Leaders</i> | Science World, Vancouver BC |
| <ul style="list-style-type: none"> • Outreach program for engaged, highly motivated high school students interested in STEM fields. | |
| Workshop Organizer and TA | Jan 2018 – June 2018 |
| <i>Brian Wetton</i> | UBC IAM, Vancouver BC |
| <ul style="list-style-type: none"> • Organizing the BC Data Science Workshop for June 2018 | |
| Convener | Jan 2017 – Aug 2018 |
| <i>BC Data Colloquium</i> | UBC IAM, UBC DSI, PIMS, CANSSI |
| <ul style="list-style-type: none"> • Organizing speakers for the monthly BC Data colloquium • Previous and upcoming talks available at bcdata.ca | |
| Workshop Organizer and TA | Jan 2017 – Aug 2017 |
| <i>Brian Wetton</i> | UBC IAM, Vancouver BC |
| <ul style="list-style-type: none"> • Organizing the IAM Data Science Workshop for August 2017 | |
| CMS Student Committee (STUDC) | Canadian Mathematical Society |
| <i>Co-Chair, Student Director</i> | <i>June 2015 – Present</i> |
| <ul style="list-style-type: none"> • 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) | Canadian Mathematical Society |
| <i>Webmaster</i> | <i>July 2013 – Present</i> |
| <ul style="list-style-type: none"> • 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 | University of Toronto |
| <i>Graduate Student Union Course Representative</i> | <i>Sept 2013 – August 2014</i> |
| <ul style="list-style-type: none"> • 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 | University of Toronto |
| <i>Mentor</i> | <i>January – April 2014</i> |
| <ul style="list-style-type: none"> • 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 (<i>cf.</i> project webpage) | |
| Engineering and Science Olympics | McMaster University |
| <i>Volunteer Co-ordinator</i> | <i>Oct. 2012</i> |
| | <i>Oct. 2011</i> |

- 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