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Education

University of British Columbia

Ph.D. Candidate — Applied Mathematics

Vancouver, BC
Sep 2015 – Aug 2021

- 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
Sep 2013 – Aug 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
Sep 2009 – Aug 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)

Selected Research Experience

Graduate Researcher — Compressed Sensing & Machine Learning

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

Sept 2015 – Present
Vancouver, BC

- Researching convex methods for compression and recovery of structured high-dimensional data using geometric functional analysis and high-dimensional probability.
- Researching deep learning methods for medical imaging with applications to ophthalmology and the automated investigation of patient health.
- Experienced user of PyTorch for training deep neural networks.

Data Scientist — Feature Selection & Signal Processing

Andrea Palmer, Paul Fijal

Oct 2016 – Feb 2017
Awake Labs, Vancouver, BC

- Mitacs Accelerate internship: affective computing R&D for quality of life improvement in children on the autism spectrum.
- Researched optimization & feature selection methods for structured time series analysis.

Graduate Researcher — Medical Imaging Algorithms

Supervisor: Dr. Adrian Nachman, University of Toronto

May – Aug 2014
Toronto, ON

- Researched variational methods in image processing to develop fast computational methods with applications to medical imaging.
- 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

Supervisor: Dr. Nicholas Kevlahan, McMaster University

May – Aug 2013
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 according to 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 (using `nlme`, `stats`, and `RandomFields` in R).
- Created protocols in R to 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

Articles Published & In-progress

- [1] **AB**, Y. Plan, and O. Yilmaz, “A well-ordering property for proximal operators,” (*in preparation*), 2020.
- [2] **AB**, G. Ozturan, D. Maberley, O. Yilmaz, and I. Oruc, “A deep learning approach to understanding retinal fundus imaging,” (*in preparation for PLOS One*), 2020.
- [3] **AB**, Y. Plan, and Ö. Yilmaz, “On the best choice of LASSO program given data parameters,” *submitted to IEEE Transactions on Information Theory*, 2020.
- [4] **AB**, “Deep generative demixing: Error bounds for demixing subgaussian mixtures of Lipschitz signals,” *submitted to IEEE ICASSP*, 2021.
- [5] **AB**, “Deep generative demixing: Recovering Lipschitz signals from noisy subgaussian mixtures.” [arXiv:2010.06652](https://arxiv.org/abs/2010.06652), October 2020.
- [6] **AB**, Y. Plan, and Ö. Yilmaz, “Sensitivity of ℓ_1 minimization to parameter choice,” *Information and Inference: A Journal of the IMA*, 2020. [doi:10.1093/imaiai/iaaa014](https://doi.org/10.1093/imaiai/iaaa014).
- [7] **AB**, Y. Plan, and O. Yilmaz, “Parameter instability regimes in sparse proximal denoising programs,” in *SampTA*, 2019. [doi:10.1109/SampTA45681.2019.9030982](https://doi.org/10.1109/SampTA45681.2019.9030982).
- [8] **AB** and E. White, “Up in the air: The mathematics of juggling,” *CruX Mathematicorum*, vol. 45, no. 8, pp. 471–475, 2019. ([link to pdf](#)).
- [9] G. S. Karagiannis, **AB**, 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*, vol. 7, no. 4, pp. 826–839, 2013. [doi:10.1016/j.molonc.2013.04.002](https://doi.org/10.1016/j.molonc.2013.04.002).

Selected Research Talks

The Mathematics of Sparse Recovery and Machine Learning CAIMS-SIAM AN20
Parameter sensitivity in ℓ_1 minimization Jul 2020

- Invited research talk on probabilistic tools for analyzing LASSO parameter sensitivity.

Virtual Vision Sciences Society 2020 Vision Sciences Society
Learning from few examples: Classifying sex from retinal images Jun 2020

- Accepted research poster on deep learning performance for ophthalmology applications.

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

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

SampTA 2019*13th International Conference on Sampling Theory and Applications*

Université Bordeaux

Jul 2019

- Accepted research talk on sensitivity of ℓ_1 minimization to parameter choice.

UBC Department of Ophthalmology & Visual Sciences*35th Annual O&VS Research Day*

VGH/UBC Eye Care Centre

April 2019

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

The mathematics of juggling*PIMS Mathematical Education Circles*

University of British Columbia

March 2019

- Talk on the “lighter side of mathematics”.
- Introduced high school teachers, teaching faculty and research faculty to the mathematics underlying juggling.
- Facilitated a mini-workshop in which participants learned to juggle in “ten minutes or less”.

Computational Math Seminar*SFU Computational Math Seminar*

Simon Fraser University

March 2019

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

Banff International Research Station*Intersection of Information Theory and Signal Processing*

Banff International Research Station

October 2018

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

PIMS High Dimensional Data Analysis*Mathematical Foundations of Data Science*

University of British Columbia

August 2018

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

International Matheon Conference*Compressed Sensing and its Applications*

Technische Universität Berlin

December 2017

- Contributed research poster on sensitivity in sparse proximal denoising programs.

Selected Honours & Awards**MDS TA Award**

\$100

UBC Master’s of Data Science

Jun 2020

Margaret L. Adamson Award

\$2 000

UBC Ophthalmology and Visual Sciences

Dec 2019

Acclerate internship

\$15 000

Mitacs, Awake Labs

Oct 2016

Canada Graduate Scholarship—Doctoral (CGS-D)\$35 000 *per annum*

NSERC, UBC

Sept 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

NSERC Undergraduate Student Research Award

\$6 500

McMaster University

Summer 2012, 2013

Samuel Lunenfeld Research Award

\$6 500

Mt. Sinai Hospital, Toronto, ON

Summer 2011

Facilitation & Teaching Experience

Sessional Instructor

Dept Statistics, UBC, Vancouver BC

*UBC Masters of Data Science program**Sep 2020 – October 2020*

- Lecture and lab instructor for the 1-block course [DSCI 551: Probability & Descriptive Statistics](#)
- Created weekly lab assignments, bi-weekly quizzes and twice-weekly lectures, with focuses on: dependence, simulation, and conditional probability, contextualized for professional data science.

TA Trainer & Facilitator

Dept Mathematics, UBC, Vancouver BC

*UBC Mathematics TA Training**Sep 2018, 2019, 2020*

- Developed, led content delivery for and facilitated small-group activities for new graduate student TAs in the Department, focusing on Facilitative Teaching, Marking, online coursewares, Expectations, Communication, and Diversity.
- Developed a web-based Canvas module on Expectations & Diversity, as these topics pertain to being a Canada-based teaching assistant, mathematician and academic in the international academe.

Mathematics Host

Science World, Vancouver BC

*Future Science Leaders**Jan 2019 & Jan 2020*

- Outreach program for engaged, highly motivated high school students interested in STEM fields.
- Led content delivery and facilitated small-group activities.
- Developed modules for self-guided learning for cryptography with Python.

Workshop Organizer and TA

PIMS, UBC IAM

*BC Data Science Workshop**Jan – Jun 2017, 2018*

- Served as co-organizer for the [2017](#) and [2018](#) BC Data Science Workshop.
- Coordinated with industry mentors to develop projects of suitable scope.
- Mentored student teams through facilitation of research ideas and background knowledge.
- Designed and led 2017 [mini-project sessions](#).

Participant

UBC Dept. Mathematics

*Instructional Skills Workshop**May 2016*

- Three day intensive workshop developing effective teaching and facilitation practices, with a focus on teaching and learning in a mathematics settings.

Teaching Assistant Experience

Master of Data Science program

University of British Columbia

*Teaching Assistant**Sept 2017 – May 2020*

- UBC's professional Master of Data Science program is a year-long intensive, cut into 6 blocks of courses and a capstone project.
- Facilitated course labs. Hosted office hours and problem solving sessions. Developed detailed assignment solutions. Marked and provided detailed feedback for students' assignment submissions. Provided feedback and review of draft assignments before they were released to students.
- Detailed course descriptions [available here](#). A list of courses for which I've served as TA are included below.
- 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
- 2019: Descriptive Statistics and Probability for Data Science, Statistical Inference and Computation I, Supervised Learning I, Supervised Learning II, Spatial and Temporal Models, Advanced Machine Learning

Multivariable and Vector Calculus

University of British Columbia

*Teaching Assistant**Jan 2015 – Apr 2015*

- Second year calculus for electrical engineers; co-syllabus with the electrical engineering electrostatics course.

- Graded students' midterms and biweekly assignments; required knowledge of electrodynamics, multivariable calculus, linear algebra.

Math Learning Centre

University of British Columbia

Teaching Assistant

Sep 2015 – Dec 2016

- Served in several roles for a drop-in help centre run by the Math Department.
- “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”: create novel explanations for class-learned concepts to address student questions.

Biology, Models and Mathematics

University of Toronto

Teaching Assistant

Sept 2013– Apr 2014

- First year math course for Biology students, requiring instruction to be delivered in a way that is relevant and appropriate for Biology students.
- Graded students' weekly assignments and provided feedback to students' instructor.
- Held two weekly hour-long office hours that were well-attended.

Engineering Mathematics IV

McMaster University

Undergraduate Teaching Assistant

Jan – Apr 2013

Jul – Aug 2012

- Second-year second-term Engineering Mathematics course covering vector calculus, Fourier series, linear algebra, graphical visualization and MATLAB.
- Graded students' midterms, weekly lab assignments.
- Led two twice-weekly labs to review course content using slides I created in L^AT_EX
- Responded to students' questions via e-mail and during office hours.

Calculus for Math and Stats I

McMaster University

Undergraduate Teaching Assistant

Sept – Dec 2012

- Designed and 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 and 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

Other Outreach & Service

Convener

UBC IAM, UBC DSI, PIMS, CANSSI

BC Data Colloquium

Jan 2017 – Aug 2018

- Organized speakers for a monthly colloquium.
- Previous and upcoming talks available at bcdata.ca.

CMS Student Committee (STUDC)

Canadian Mathematical Society

Co-Chair, Student Director

Jun 2015 – Jun 2018

- Coordinated and directed operations of the (national scale) CMS student committee and its members.
- Managed the largest budget of any CMS committee.
- Served as representative of Canadian math students and as liaison with CMS leadership.
- Reviewed student conference funding proposals, and awarded student prizes for academic achievement in the form of poster printing subsidies and conference bursaries.