

jacobdenson

Mathematician

Research Interests

Harmonic Analysis,
Geometric Measure
Theory, Additive
Combinatorics

Contact Information

denson@math.ubc.ca

Github Profile: [jdjake](#)

Stack Overflow:

[jacob-denson](#)

Website:

<https://jdjake.github.io/>

Education

2017-Present

Masters in
Mathematics at the
University of British
Columbia (Thesis:
Cartesian Products
Avoiding Patterns).

2013-2017

Bachelors in
Computing Science at
the University of
Alberta.

Languages

English, Elementary
Mandarin, Python, Perl,
C++, C, C#, Matlab,
HTML, Javascript,
Latex

Research Projects

2018-Now **Large Sets Avoiding Rough Patterns**

Collaboration with Dr. Malabika Pramanik and Dr. Joshua Zahl. In this project, we hope to find subsets of Euclidean space with large fractal dimension avoiding particular point configurations, which might be described as having a 'rough' character. In April, we submitted a paper constructing configuration avoiding sets with large Hausdorff dimension entitled [Large Sets Avoiding Rough Patterns](#). We also have new results about 'low rank' configurations, and Salem sets avoiding rough sets, which we are currently transcribing into a paper to be submitted soon.

2017-Now **Lagrangian Preserving Approximation for Vehicle Routing**

Collaboration with Dr. Zachary Friggstad. This project involves using the Lagrangian preserving approximation technique combined with a novel linear relaxation of variants of the vehicle routing problem to obtain state of the art approximation algorithms. Our work is detailed in notes linked [here](#). We plan to organize our thoughts into a paper in the new year.

2015-2016 **Universal Store Record Linkage**

Collaboration with Dr. Aman Kansal and Ram Chandrasekaran. As an intern, developed data linkage methods in Microsoft's Universal Store department in Redmond, Washington. My main responsibility was reading articles and white papers on the record linkage problem, and developing the ideas in those papers into usable software. My software removed redundant information from Microsoft's database, which took up 20% of the size of the entire database.

2014 **Cognate Identification**

Collaboration with Garret Nicolai and Dr. Greg Kondrak. Developed cognate recognition algorithms with the NLP group at the University of Alberta. Created a centralized database for storing cognate information. This program was successfully used by linguists at the University of Alberta to understand the Totonac language group. Garrett Nicolai supervised the project (Nicolai@ualberta.ca).

Publications

[Cartesian Products Avoiding Patterns \(MSc Thesis\)](#)

Jacob Denson

(Submitted Dec 2019)

[Large Sets Avoiding Rough Patterns](#)

Jacob Denson, Malabika Pramanik, Joshua Zahl

Accepted for Publication in Springer Series Harmonic Analysis and Applications (Submitted Apr 2019)

[Proofs in Three Bits or Less \(Expository Article\)](#)

Jacob Denson

CMS Notes from the Margin (Mar. 2018)

Awards

2019

February Fourier Talks
Poster Presentation
Award (2nd Place)

2018

NSERC CGSM
UBC Science Graduate
Award
(2nd Time)

2017

UBC Science Graduate
Award
U of A Dean's Silver
Medal in Science
NSERC USRA
(2nd and 3rd Time)

2016

Jason Lang
Scholarship
(3rd Time)

2015

Jason Lang
Scholarship
(2nd Time)

2014

NSERC USRA
Jason Lang
Scholarship

2013

U of A Academic
Excellence Scholarship
U of A Science
Academic Excellence
Scholarship
Alexander Rutherford
Achievement
Scholarship

Teaching Assistantships

2019

Multivariate Calculus
Graph Theory

2018

Introduction to Discrete
Mathematics
Introduction to
Probability

2017

Calculus for Forestry
Students
Calculus for Business
Students

2015

Tangible Introduction
to Computer Science
Undergraduate TA

Conference Presentations

2018-2019 **Fractals Avoiding Fractal Sets**

Presented at:

- *The 2018 Mid-Atlantic Analysis Meeting.*
- *The 2018 CMS Winter Meeting.*
- *The 2019 Geometric and Harmonic Analysis (GAHA) Conference.*
- *Poster at the 2019 February Fourier Talks. Awarded Prize for 2nd Best Poster out of 19 participants.*
- *Poster at the 2019 Madison Lectures in Fourier Analysis.*

A talk discussing my work with Dr. Malabika Pramanik and Dr. Joshua Zahl on constructing high dimensional sets avoiding configurations. I emphasized the idea behind the discretization of a problem when working a single scale, as well as the phrasing of the discrete problem in terms of constructing independent sets in a hypergraph.

2016 **Molecular Gases and the Natural Numbers**

Presented at the Canadian Undergraduate Mathematics Conference. An expository talk introducing ergodic theory to undergraduate students, emphasizing its relation to a variety of problem in mathematics, especially number theory.

Miscellaneous Talks

Notes for my Talks can be found at my website: <https://jdjake.github.io>.

2019 **Incidence Theorems over Field of Arbitrary Characteristic** *Math 616A Class*

2018 **Hodge Theory: Harmonic Analysis in Topology** *Math 529 Class*

2018 **Theta Functions** *Math 600D Class*

2018 **Radon Transforms and Exceptional Projections** *Math 542 Class*

2017 **Proofs in Three Bits or Less** *UBC Graduate Seminar*

2016 **Why Physicists Care About the Fourier-Stieltjes Transform** *Math 642 Class*

2016 **A Brief Respite in Abelian Harmonic Analysis** *Math 642 Class*

2016 **Vector Fields, Hex, and Jordan Curves** *Math 530 Class*

2015 **Category Theory for Programmers** *University of Alberta Honors Seminar*