

Blair Drummond

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Mathematician.

Looking for problems to solve and questions to uncover.

My academic background is in mathematics and random graphs, but I also spent a few years studying linguistics and computer science. Reflective of that, my interests are in more interdisciplinary approaches to problem solving and [framing](#). I like learning about how mistakes get made (Kahneman, Taleb, Don Norman), [why reasonable people disagree](#), and how problems get [identified and placed in a framework](#). On the math side, I am interested in learning more about time-series analysis, Markov chains, spectral graph theory, and [social network analysis](#) — including applications such as [filter bubbles](#), [online dating and random graph processes](#), as well as twitter, fake news, and virality.

Education

M.Sc. in Mathematics

University of Ottawa, 2017-2019

Thesis on the Benjamini-Schramm limits of Rauzy graphs of low-complexity words. Supervised by Dr. Vadim Kaimanovich. *Successfully defended August 7, 2019. Slides available [here](#); thesis available [here](#).*

Honours B.Sc. in Mathematics

University of Ottawa, 2013-2017

Honours project on ergodic theory and fractal geometry, studying dynamics of the “zoom” transformation to study the Minkowski and Hausdorff dimension of a fractal. Before switching into mathematics I also studied computer science and linguistics (≈ 2 years). Graduated magna cum laude.

Jobs & Projects

R Programmer and Consultant

University of Ottawa, 2017-2019

Authored an R library for analysis of single ion-channel experiments for [the daCosta lab](#). I am the principal author of a [published paper](#) on the library. The package is available on CRAN under the name [scburstts](#).

Workshop Leader: Python+Linux for Machine Learning

University of Ottawa, Summer 2017

Ran a weekly workshop for a machine learning group at the University of Ottawa. The students and professors had a local server, and I gave demonstrations with Jupyter, Anaconda, `ssh`, `tmux`, and showed how to use and navigate the remote server and keep tabs on processes with tools like `ps` and `top`. I also introduced libraries like SymPy.

Member of Mathematics Reading Group

University of Ottawa, 2016-2019

Participated in and contributed to a mathematics reading group of four members. We studied algebraic geometry, category theory, probability & dynamical systems, and complex analysis. We also took on an original research problem from a professor and we solved it. That is now a submitted paper. (See § [Works & Publications](#))

Teaching Assistant (Math & Computer Science)

University of Ottawa, 2016-2019

Led labs, tutored, and ran tutorials for Data-Structures & Algorithms, Discrete Math, Calculus I & II, and Linear Algebra. I once had a student email me after the course and comment on my teaching: “please pursue academia in the future”.

Developer (Automation)

Sonus Networks, Summer 2015

Developed automation tools for testing the deployment of operating system upgrades and rollbacks to servers over a network, working in linux environment with python. Worked extensively on parallel processing of tasks.

NLP Research Assistant

University of Ottawa, Fall 2014

Did natural language processing work in python with NLTK, extracting statistics from a corpus of poems as a computational linguistics project. Presented a research poster on my work.

Technical Skills

Analysis, Probability, and Graphs

- Expertise in ergodic theory of discrete dynamical systems, random graphs, and symbolic dynamics.
- Adept with time-series, Markov chains, graph theory (including algorithms), de Bruijn graphs and Rauzy graphs, discrete time stochastic processes, representations of abstract dynamical systems.
- Advanced knowledge of functional analysis & measure theory, probability theory, and commutative algebra.
- Applied Markov chain theory to NLP and models for protein kinetic mechanisms.
- In my fourth year I took a PhD level reading course (for graduate credit) on Markov processes and gave a talk on hidden Markov models.
- Wrote a small graph-theory / mathematical programming program in Haskell. [Rauzy graphs](#).

Topology, Machine Learning & Beyond

- Co-author of an original paper on a topology problem — a joint project with my reading group, with whom I also studied algebraic geometry, dynamical systems, commutative algebra, and category theory.
- Experience with machine learning & statistics, linear algebra over rings (module theory), (Lie) manifolds, data-structures and algorithm analysis, as well as logic, and number theory.

Computing

- Experience with screen-scraping and NLP in python.
- Experience with machine learning in SciKit-Learn.
- Ran a python+linux workshop for a machine learning group at the University of Ottawa.
- Work on [bioinformatics](#) data in Haskell and Go.
- Network programming and automation work in python.
- Professional experience in R and C++ designing intuitive tools for scientists.
- Open source contributor in Lisp, C/C++.

Works & Publications

- Github profile
- My Master's thesis
 - Script/slides for my thesis defence
- The R library that I wrote
 - The paper we published on it
- My talk on the normal number theorem
- Research poster for my old NLP project

github.com/blairdrummond/
<https://ruor.uottawa.ca/handle/10393/39594>
[bdrummond.com/files/thesis-slides-long.pdf](https://ruor.uottawa.ca/handle/10393/39594)
[CRAN.R-project.org/package=scbursts](https://cran.r-project.org/package=scbursts)
sciencedirect.com/science/article/pii/S2352711019300810
[bdrummond.com/files/normal-numbers.pdf](https://ruor.uottawa.ca/handle/10393/32644)
ruor.uottawa.ca/handle/10393/32644

- [1] Blair Drummond. Limits of Rauzy graphs of low-complexity words. Master's thesis, Université d'Ottawa/University of Ottawa, 2019.
- [2] Blair R. Drummond, Christian J.G. Tessier, Mathieu F. Dextraze, and Corrie J.B. daCosta. scbursts: An R package for analysis and sorting of single-channel bursts. *SoftwareX*, 10:100285, 2019.
- [3*] *Submitted*: co-author of “Finiteness spaces, étale groupoids and their convolution algebras”. A topology project of my reading group.

Tools and Environments

- 10+ years of experience as a linux user, with 5+ years programming on a range of distributions across personal computers and on servers.
- Experience with Docker, [git](#), virtual machines, build environments, hosting and the web.
- Some experience with Google BigQuery, PostgreSQL.
- Some experience with PGP and AES encryption.

Algorithms

- I got $\approx 100\%$ in my *Data Structures and Algorithms* course and I later became a teaching assistant while in undergrad after my professor recognized me on the street (two years later) and offered me the job.
- Interested in parallelizability, and have written parallelized code and GPU code in Haskell (CUDA), Python and GoLang. I am learning more about it in Julia.
- Studied distributed optimization algorithms such as ant-colony optimization, as well as ML algorithms such as random forests, support vector machines, naïve Bayes, neural networks (autoencoders, recurrent NNs), manifold learning, topological data analysis.

Languages and Libraries

- Experience with Python, Jupyter, [nlTK](#), [scikit-learn](#), [pandas](#), [multiprocessing](#), [beautifulsoup](#).
- R, Rcpp (C++ integration).
- Learning Julia.
- Shell, Awk, Sed, and more. Aspiring Linux guru.
- C, Go, Java, and Haskell. I like fast things.
- Basic web development; html, css, javascript, php.
- Knowledgeable in documentation systems and markup languages: \LaTeX , markdown, transpilers, and more.

Miscellaneous

- I have been told that I am a good teacher. I also think that I have taste for good design.