Spencer R. Szabados, (B.Sc.)

Contact Information

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About

Graduate student at University of Waterloo supervised by Yao-liang Yu, specializing in Machine Learning; specifically, Statistically based methods such as Sum Product Networks and Diffusion Models. My background is in Applied Mathematics and Computer Science. Passionate about problem solving, with key areas of interest being Computational Mathematics and Statistics, Numerical Analysis. Avid reader, mostly on topics relating to Human Decision Making, Finance, and a more casual obsession of so-called space-opera and classic/hard Sci-fi in general.

Education and Certificates

Jan. 2023 - Current	Master's of Mathematics in Computer Science, **University of Waterloo**, Canada. Specializing in Machine Learning.
Feb. 2022	Bachelor's of Science in Mathematics, **University of Manitoba**, Canada. Specialized in Applied Mathematics and Theoretical Computer Science. Graduated with Distinction.
June. 2020	*Certificate* in Front-End Web Development *(15 hours)*, **Udemy**, Instructed by Joseph Delgadillo and Nick Germaine. Course detailed the use of html5, css, JavaScript, and jQuery in the design and deployment of custom dynamic websites.
June. 2016	Highschool Diploma, **Institut Collégial Vincent Massey Collegiate**, Canada. Graduated with Honors.

Awards

July. 2024	Vector Institute Research Bursary. *Awarded to full-time graduate studies at a Canadian educational institution during the Fall 2022 and/or Winter 2023 semesters in good academic standing and are supervised by a Vector Faculty Member.*	($2000)
Jan. 2023	University of Waterloo Graduate Scholarship. *Awarded to graduate students registered full time in a Master's program with a minimum first-class (80%) cumulative average in their current program or over the last two full-time academic years.*	($10,000)
Jan. 2022	Faculty of Science Undergraduate Research Bursary. *Awarded to undergraduate students to fund their research while working under the supervision of individual professors.* This was awarded to me twice working under Stephane Durocher.	($10,000)
Oct. 2021	Philosophia Mathematica Prize in Applied Mathematics. *Awarded to best applied mathematics student in either second or third year.*	($3850)
Sept. 2016	Faculty of Science Entrance Bursary.	($2000)

Publications

2023 *CM-GAN: Stabilizing GAN Training with Consistency Models.* (ICML2023 Workshop)
Haoye Lu, Yiwei Lu, Dihong Jiang, **Spencer Szabados**, Sun Sun, and Yaoliang Yu.
To overcome the problem of instability encountered while training GANs we replace the standard generator architecture with a pretrained Consistency Diffusion Model. In this way, we provide a method to combine the main strengths of diffusion and GAN models while mitigating both their major drawbacks. Additionally, as the technique can also be viewed as a method to fine-tune the consistency models using a discriminator, its performance is expected to outperform CM in general. We provide preliminary empirical results on MNIST to corroborate our claims.

2022 *Curve Stabbing Depth: Data Depth for Plane Curves.* (CCCG 2022.)
Stephane Durocher and **Spencer Szabados**.
A novel depth measure for plane curves and functional data is proposed from a computational geometry perspective, focusing on the development and analysis of an exact algorithm for computing the fomented depth for arrangements of polylines. Unlike many of the contained cited works, the proposed depth measure does not depend on assumptions about the underlying population from which curves are drawn, nor on notions of comparative curve morphology. Rather, simply being based on minimization of the stabbing number of a ray rotated about each point along a curve. A Connections can be drawn between this notion of depth and (generalizations of) well-established depth measures, notably Maximal Regression Depth, Halfplane Depth, and Band Depth to name a few.

Employment

Academic

Jan-Apr. 2024 / Sep-Aug 2023 — Teaching Assistant CS335 - Computational Methods in Fiance,
University of Waterloo, Waterloo.
Covering the design and analysis of algorithms for simulating financial stock pricing, the derivation and theory surrounding stochastic differential equations, Black-Scholes finance model, etc...)

Jan-Apr. 2023 — Teaching Assistant CS330 - Infrastructure Management,
University of Waterloo, Waterloo.
Covering the design and analysis Computing Infrastructure and Networking, how to price compare distributor options, etc...

May-Aug. 2022 / Jan-Apr. 2022 — Undergraduate Research Assistantship,
University of Manitoba, Winnipeg.
Assistantship Recently extended for an additional term. Due to my academic standing and complementary performance within Dr.Stephane Durocher's co-listed graduate course on Computational Geometry. I received a bursary to further my academic development through a collaborative research project with Dr.Durocher, working on the definition and analysis of a novel depth measure and associated exact algorithm for curve and functional data. See, *Curve Stabbing Depth: Data Depth for Plane Curves.* above.

Jan-Apr. 2022 — Teaching Assistant for CS3170 Advanced Design of Algorithms,
University of Manitoba, Winnipeg.
Covering the design and analysis of *advanced* algorithms and data structures with adherence to established protocols and standards. (e.g., Amortized analysis, Fibonacci heaps, Randomized data structures and Expected running time analysis, Skip lists etc...)

Skills and Projects

Technical : Microsoft Office suite, LaTeX and Markdown typesetting, Administration of Linux systems (e.g., Ubuntu, Proxmox *hypervisor.*)

Programming

Familiarity with a number of well established programming languages and related technologies:

Languages : R, Python, C, Java.
Web-design : html5, css, JavaScript, Hugo *(web framework).*
Technologies : Git, Docker.

Data Science

Experienced in using R to perform rudimentary computational data analysis for the purposes of data communication and summary, such as Data Sanitation best practices, k-dimensional regression with Data inferencing and prediction on large samples, generating multivariant sample statistics (e.g., Tukey median, Oja median, Weber point, generalizations of α-trimmed means), along with numerous standard data visualizations (e.g., Box-plots, Density and Heat maps, etc...).

Notable Undergraduate Works

Commentary paper on Moore Graphs.	The goal being the *independent* derivation and presentation of the material contained within the seminal paper *On moore graphs with diameters 2 and 3* by A.J. Hoffman and R.R. Singleton (1960), while presuming the reader to have very limited familiarity of the assumed preliminaries. This required the identification and accurate summarization of key concepts within Graph Theory, Linear Algebra, and Abstract Algebra; e.g., Spectral and Algebraic Graph Theory, Permutation Groups, and Canonical Matrix Factorization. The resulting monograph totaled 18-pages, emphasising the density of the original 6-page text. Project presented for final evaluation in a co-listed graduate course on Linear Algebra and Matrix Theory.
Introductory paper on Matroid Theory.	Project consisted of researching and presenting the historical and *current* developments of Matroid Theory, starting from those initially made in the paper *On the abstract properties of linear dependence* by H. Whitney (1935). In summary, Matroid theory generalizes the notion of linear dependence across numerous seemly disparate domains by studying (constructing) equivalences between domain specific definitions and properties. Notably applications exist within Linear Algebra, Graph Theory, Projective Geometry, and some areas within Computer Science involving the design of greedy (optimization) algorithms. The final 18-page introductory paper was submitted as part of the final evaluation criteria of third year Combinatorics course.
Review paper on Minimum Ply Covering problem.	The purpose of the article review was to familiarize yourself with a current topic within Computational Geometry by writing a detailed summary of a recent publication, in addition to related developments and surrounding contextual information of the problem. The paper *Minimum Ply Covering of Points with Convex Shapes* by A. Biniaz and Z. Lin (2020) was selected for this purpose. The problem studied being to efficiently determine a selection from predefined regions that will cover a set of points while minimizing the region of maximal overlap. The problem was selected due to both it's theoretical interest and immediate real world applications in the design of wireless network layouts that minimize interference that results from overlap. Presented as part of the final evaluation criteria within a co-listed graduate course in Computational Geometry.