ALUN CENNYTH STOKES

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RESEARCH INTERESTS

My interests lie in **mathematics and computing**, particularly **number theory** and **symbolic algebra**. Very recent interests include homotopy continuation and symbolic regression. Generally, I study **dessins d'enfants**, and my work is often predicated on the computation of **Belyi maps** from permutation representations and passports. I often write software for **high-performance, parallel, and distributed computing** and have reasonably extensive experience with a broad range of **modern machine learning** techniques.

EDUCATION

Master of Science (Pure Mathematics) September 2021 - April 2023
McMaster University
Supervisor: *Dr Cameron Franc*

Bachelor of Integrated Science (Mathematics & Statistics) September 2017 - June 2021
McMaster University Honours: *summa cum laude* (10.8/12 cGPA)
Supervisor: *Dr Cameron Franc* *The Search for Self-Contained Numbers*

PUBLICATIONS

[1] **Stokes, A.** Hum, W., Zaslavsky, J. **STEM Fellowship Journal.** **6**(1): 1-5. Available at A Minimal-Input Multilayer Perceptron for Predicting Drug-Drug Interactions.

[2] † **Stokes, A.** Automatically Solving Square-Piece Jigsaw Puzzles using Convolutional Neural Networks with Gradient Boosted Decision Trees. **The Undergraduate Journal.** (12th edition). Accessible at: Automatically Solving Square-Piece Jigsaw Puzzles.

[3] † * **Stokes, A.** The search for self-contained numbers: k-special 3-smooth representations and the Collatz conjecture. **MacSphere**, 2021, [Online]. Available at: The search for self-contained numbers.

*Entries marked with † have **not** been peer-reviewed.* *Entries marked with * are theses.*

FUNDING, GRANTS, AND AWARDS

Ontario Graduate Scholarship May 2022 - April 2023
$ 15,000 **Competitive**

NSERC USRA May 2021 - August 2021
$ 8,120 **Competitive**

Oriel College (Oxford University) General Funding †*Declined*
£10,000 **Non-competitive**

Dean's Honour List September 2017 - April 2021
Awarded all 4 years of undergraduate degree **Non-competitive**

Global Undergraduate Awards September 2020
1^{st} *place for computer science in North America* **Competitive**

McMaster Stewart Award May 2020
$ 3,750 **Competitive**

CANDEV Data Challenge January 2020
1^{st} *place (out of ~350 participants in small teams)* **Competitive**

STEM Fellowship Big Data Competition July 2019
$ 3,000 **Competitive**

McMaster President's Award September 2017
$ 2,500 **Non-competitive**

† indicates an award was declined due to not attending the funding institution.

TEACHING ASSISTANTSHIPS

McMaster University January 2022 - April 2022
Graduate Topics in Risk Management MFM 763
Introductory Number Theory MATH 3H03

McMaster University September 2021 - December 2021
Numerical Linear Algebra MATH 3NA3
Linear Algebra I MATH 1B03

McMaster University January 2021 - April 2021
Introduction to Discrete Mathematics *CS 1DM3*

RESEARCH EXPERIENCE

Research Assistant May 2021 - August 2021
McMaster University *Dr Cameron Franc*

Investigated machine learning strategies to discriminate non-congruence finite-index subgroups of the modular group and compute Belyi maps corresponding to dessins d'enfants.

Data Scientist June 2020 - August 2020
Statistics Canada *Consumer Prices Division (Serge Goussev)*

Developed NLP methods for hierarchical data structure mapping to aid in calculating the consumer price index.

Research Assistant May 2020 - July 2020
McMaster University *Dr George Dragomir, Dr Andy Nicas*

Building on work by Dragomir and Nicas, we investigated how quasi-hyperbolicity could be exploited to reduce roughness and distortion in quasi-isometric graph embeddings.

Research Assistant May 2019 - May 2020
McMaster University *Dr Ned Nedialkov*

Developed convolutional neural networks to segment photoacoustic breast images for a group from Western University developing a hand-held *in-situ* scanner.

INVITED TALKS AND SEMINARS

Algebra and Algebraic Geometry Seminar November 2021
McMaster University *An Introduction to Belyi Maps*

Gave a 30-minute presentation on dessins d'enfants, their relevance, and pertinent computational techniques used in my research open to McMaster's math faculty and graduate students.

Undergraduate Big Data Competition July 2019
STEM Fellowship *Predicting Drug-Drug Interactions Without Knowledge of Drug Structure*

This was a talk given with coauthors on our method of using machine learning to predict *in-vivo* drug-drug interactions using only analytical chemical properties. This was held at York University.

OTHER PRESENTATIONS

Synopsis 2021 April 2021
McMaster University *k-special 3-smooth Representations and the Collatz Conjecture*

A 15-minute expository talk on a formulation of the Collatz conjecture by a family of Diophantine equations and a conjecturally sparse set of numbers that are 'almost' solutions.

CANDEV January 2020
Government of Canada *Using Transformer-based Embeddings to Identify Course Redundancies*

Gave a short talk on our use of transfer-learning with a transformer model to cluster courses offered by the Canadian School of Public Service and identify redundancies in course offerings.

TECHNICAL SKILLS

Languages†	Python, **Julia**, Java, MATLAB, C/C++, CUDA SQL, Mathematica
Major Libraries†	**SageMath**, Pytorch, HomotopyContinuation.jl, Macuaulay2
Software & Tools	LaTeX, Git, MySQL
Operating Systems†	**GNU/Linux** (Ubuntu, primarily), MacOS, Windows

†*Listed in order of proficiency* ***Bolding*** *indicates preferentiality*

OTHER PROJECTS

Global Undergraduate Awards September 2021
Dr Ned Nedialkov *Fully Automated Jigsaw Puzzle Solving by Hybrid ML*

Won first place in North America for a paper on hybrid machine learning techniques to solve square-piece jigsaws; state-of-the-art matching accuracy was reported.

National Big Data Competition June 2020
Dr Yasaman Amannejad *Medication Recommendation by Matrix Factorization*

Devised a matrix factorization-based recommender system to predict effective drugs for treating several mental illnesses, given a patient's history with other drugs.

PROFESSIONAL ORGANIZATIONS (TO WHICH I BELONG)

American Mathematical Society (AMS) *September 2021 - Present*

Society for Industrial and Applied Mathematics (SIAM) *July 2022 - Present*

REFERENCES

Are available upon request, preferably made to stokea1@mcmaster.ca.