

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) <i>McMaster University</i> Supervisor: <i>Dr Cameron Franc</i>	September 2021 - April 2023
Bachelor of Integrated Science (Mathematics & Statistics) <i>McMaster University</i> Supervisor: <i>Dr Cameron Franc</i>	September 2017 - June 2021 Honours: <i>summa cum laude</i> (10.8/12 cGPA) <i>The Search for Self-Contained Numbers</i>

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 \$ 15,000	May 2022 - April 2023 Competitive
NSERC USRA \$ 8,120	May 2021 - August 2021 Competitive
Oriel College (Oxford University) General Funding £10,000	[†] <i>Declined</i> Non-competitive
Dean's Honour List <i>Awarded all 4 years of undergraduate degree</i>	September 2017 - April 2021 Non-competitive

Global Undergraduate Awards <i>1st place for computer science in North America</i>	September 2020 Competitive
McMaster Stewart Award <i>\$ 3,750</i>	May 2020 Competitive
CANDEV Data Challenge <i>1st place (out of ~350 participants in small teams)</i>	January 2020 Competitive
STEM Fellowship Big Data Competition <i>\$ 3,000</i>	July 2019 Competitive
McMaster President's Award <i>\$ 2,500</i>	September 2017 Non-competitive

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

TEACHING ASSISTANTSHIPS

McMaster University <i>Graduate Topics in Risk Management</i> <i>Introductory Number Theory</i>	January 2022 - April 2022 MFM 763 MATH 3H03
McMaster University <i>Numerical Linear Algebra</i> <i>Linear Algebra I</i>	September 2021 - December 2021 MATH 3NA3 MATH 1B03
McMaster University <i>Introduction to Discrete Mathematics</i>	January 2021 - April 2021 CS 1DM3

RESEARCH EXPERIENCE

Research Assistant <i>McMaster University</i>	May 2021 - August 2021 <i>Dr Cameron Franc</i>
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 <i>Statistics Canada</i>	June 2020 - August 2020 <i>Consumer Prices Division (Serge Goussev)</i>
Developed NLP methods for hierarchical data structure mapping to aid in calculating the consumer price index.	
Research Assistant <i>McMaster University</i>	May 2020 - July 2020 <i>Dr George Dragomir, Dr Andy Nicas</i>
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 <i>McMaster University</i>	May 2019 - May 2020 <i>Dr Ned Nedialkov</i>
Developed convolutional neural networks to segment photoacoustic breast images for a group from Western University developing a hand-held <i>in-situ</i> 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, Macaulay2**Software & Tools**L^AT_EX, 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 stokeal@mcmaster.ca.