

ALUN CENNYTH STOKES

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RESEARCH INTERESTS

My interests lie in computing and mathematics, particularly number theory and symbolic algebra. I am currently interested in dessins d'enfants and the computation of their Belyi maps. I write software for high-performance and distributed computing and have substantial experience in various 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>
Turner Fenton Secondary School <i>International Baccalaureate Program</i>	September 2013 - June 2017 97% cGPA

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.*

GRANTS AND AWARDS

Ontario Graduate Scholarship \$15,000	May 2022 - April 2023 Competitive
NSERC USRA \$8,120	May 2021 - August 2021 Competitive
Dean's Honour List <i>Awarded all 4 years of undergraduate degree</i>	September 2017 - April 2021 Non-competitive
Global Undergraduate Awards 1 st place for computer science in North America	September 2020 Competitive

McMaster Stewart Award
\$3,750

May 2020
Competitive

CANDEV Data Challenge
1st place

January 2020
Competitive

STEM Fellowship Big Data Competition
\$3,000

July 2019
Competitive

McMaster President's Award
\$2,500

September 2017
Non-competitive

TEACHING ASSISTANTSHIPS

McMaster University
Graduate Topics in Risk Management
Introductory Number Theory

January 2022 - April 2022
MFM 763
MATH 3H03

McMaster University
Numerical Linear Algebra
Linear Algebra I

September 2021 - December 2021
MATH 3NA3
MATH 1B03

McMaster University
Introduction to Discrete Mathematics

January 2021 - April 2021
CS 1DM3

RESEARCH EXPERIENCE

Research Assistant
McMaster University

May 2021 - August 2021
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
Statistics Canada

June 2020 - August 2020
Consumer Prices Division

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

Research Assistant
McMaster University

May 2020 - July 2020
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
McMaster University

May 2019 - May 2020
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.

TALKS AND SEMINARS

†Algebra and Algebraic Geometry Seminar
McMaster University

November 2021
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.

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.

†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.

Synopsis 2019

April 2019

*McMaster University**Prime Distribution by Linear Flow on the Torus*

A 15 minute expository talk on the primary findings of a 4-month project investigating prime distributions over non-intersecting curves on closed surfaces.

Entries marked with † are invited talks.

TECHNICAL SKILLS

Languages †	Python, Julia , Java, MATLAB, C/C++, CUDA, JavaScript, SQL, PHP, Mathematica
Major Libraries †	SageMath , Pytorch, HomotopyContinuation.jl, Macaulay2
Software & Tools	L ^A T _E X, 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.

REFERENCES

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