

# ALUN CENNYTH STOKES

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## RESEARCH INTERESTS

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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

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|---|--|
| <b>Master of Science (Pure Mathematics)</b><br><i>McMaster University</i><br>Supervisor: <i>Dr Cameron Franc</i>                          | September 2021 - April 2023  |
| <b>Bachelor of Integrated Science (Mathematics &amp; Statistics)</b><br><i>McMaster University</i><br>Supervisor: <i>Dr Cameron Franc</i> | September 2017 - June 2021<br>Honours: <i>summa cum laude</i> (10.8/12 cGPA)<br><i>The Search for Self-Contained Numbers</i> |
| <b>Turner Fenton Secondary School</b><br><i>International Baccalaureate Program</i>   | September 2013 - June 2017<br>97% cGPA   |

## PUBLICATIONS

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- [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] <sup>†</sup>**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] <sup>†</sup>**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 <sup>†</sup> have **not** been peer-reviewed.*

## GRANTS AND AWARDS

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

**McMaster Stewart Award**  
\$3,750

May 2020  
**Competitive**

**CANDEV Data Challenge**  
1<sup>st</sup> 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 <sup>†</sup> are invited talks.

**TECHNICAL SKILLS**


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|---------------------------------------|---|
| <b>Languages</b> <sup>†</sup>         | Python, <b>Julia</b> , Java, MATLAB, C/C++, CUDA, JavaScript, SQL, PHP, Mathematica |
| <b>Major Libraries</b> <sup>†</sup>   | <b>SageMath</b> , Pytorch, HomotopyContinuation.jl, Macaulay2                       |
| <b>Software &amp; Tools</b>           | L <sup>A</sup> T <sub>E</sub> X, Git, MySQL   |
| <b>Operating Systems</b> <sup>†</sup> | <b>GNU/Linux</b> (Ubuntu, primarily), MacOS, Windows                                |

<sup>†</sup>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**


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