ALUN CENNYTH STOKES

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RESEARCH INTERESTS

My interests lie at the intersection of computing and mathematics, particularly in number theory. I am currently interested in the theory of dessins d'enfants, and the computation of their Belyi maps. In general, I write software for high-performance and distributed computing, and have substantial experience in several areas of machine learning.

EDUCATION

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

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

Turner Fenton Secondary School   September 2013 - June 2017
International Baccalaureate Program   *Cumulative Percentage: 97%*

PUBLICATIONS

[1] **Stokes, A.** Hum, W., Zaslavsky, J. A Minimal-Input Multilayer Perceptron for Predicting Drug-Drug Interactions Without Knowledge of Drug Structure. **STEM Fellowship Journal.** **6**(1): 1-5.

[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: https://gua.soutron.net/Portal/Default/en-GB/RecordView/Index/61.

Entries marked with [†] have not been peer reviewed.

RESEARCH EXPERIENCE

Research Assistant   May 2021 - August 2021
McMaster University   *Dr Cameron Franc*
Investigated the use of machine learning strategies in discriminating non-congruence finite-index subgroups of the modular group, and strategies to compute Belyi maps corresponding to passports of dessins d'enfants.

Data Scientist   June 2020 - August 2020
Statistics Canada   *Consumer Prices Division*
Developed natural 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, how quasi-hyperbolicity could be exploited to reduce roughness and distortion in quasi-isometric graph embeddings.

Research Assistant <div align="right">May 2019 - May 2020</div>
McMaster University <div align="right">*Dr Ned Nedialkov*</div>
Developed convolutional neural networks to segment photoacoustic breast images for a group from Western University developing a hand-held *in-situ* scanner.

Math & Computer Science Tutor <div align="right">December 2013 - Present</div>
Private
Worked one-on-one with each of two students to develop skills in math and computer programming.

TEACHING ASSISTANTSHIPS

McMaster University <div align="right">January 2022 - April 2022</div>
Graduate Topics in Risk Management <div align="right">*MFM 763*</div>
Number Theory <div align="right">*MATH 3H03*</div>

McMaster University <div align="right">September 2021 - December 2021</div>
Numerical Linear Algebra <div align="right">*MATH 3NA3*</div>
Linear Algebra I <div align="right">*MATH 1B03*</div>

McMaster University <div align="right">January 2021 - April 2021</div>
Introduction to Discrete Math <div align="right">*CS 1DM3*</div>

TALKS AND SEMINARS

†Algebra and Algebraic Geometry Seminar <div align="right">November 2021</div>
McMaster University <div align="right">*An Introduction to Belyi Maps*</div>
Gave a 30 minute presentation on the topic of dessins d'enfants, their relevance, and pertitnent computational techniques used in my research to the math faculty and graduate students at McMaster.

Synopsis 2021 <div align="right">April 2021</div>
McMaster University <div align="right">*k-special 3-smooth Representations and the Collatz Conjecture*</div>
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 <div align="right">January 2020</div>
Government of Canada <div align="right">*Using Transformer-based Embeddings to Identify Course Redundancies*</div>
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 <div align="right">July 2019</div>
STEM Fellowship <div align="right">*Predicting Drug-Drug Interactions Without Knowledge of Drug Structure*</div>
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 <div align="right">April 2019</div>
McMaster University <div align="right">*Prime Distribution by Linear Flow on the Torus*</div>
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.

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 treatment of several mental illnesses, given a patient's history with other drugs.

Coursework
April 2017

Agent-Based Modelling to Simulate Tumour Growth and Progression

Simulated canine transmissible venereal tumours and the effects of the immunohistological environment of the tumour, with specific respect to MHC expression Ig concentration.

TECHNICAL SKILLS

Languages[†]	Python, Julia, Java, MATLAB, C/C++, CUDA, JavaScript, SQL, PHP, Mathematica
Major Libraries	SageMath, Pytorch, TensorFlow, HomotopyContinuation.jl
Software & Tools	LaTeX, Git, MySQL
Operating Systems[†]	GNU/Linux (Ubuntu, primarily), MacOS, Windows
Misc.	Photoshop, Illustrator

[†]Listed in order of proficiency

GRANTS AND AWARDS

NSERC USRA
May 2021 - August 2021

$ 8120

Global Undergraduate Awards
September 2020

1st Place in North America

McMaster Stewart Award
May 2020

$ 3750

CANDEV Data Challenge
January 2020

1st place in Government of Canada competition

STEM Fellowship Big Data Competition
July 2019

$ 3000