ALUN CENNYTH STOKES

Hamilton, Ontario

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Entries marked with [†] *have not been peer reviewed.*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

Math & Computer Science Tutor December 2013 - Present

Private

Worked one-on-one with each of two students to develop skills in math and computer programming.

TEACHING ASSISTANTSHIPS

McMaster University January 2022 - April 2022

Graduate Topics in Risk Management MFM 763

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 Math CS 1DM3

TALKS AND SEMINARS

†Algebra and Algebraic Geometry Seminar November 2021

McMaster University *An Introduction to Belyi Maps*

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 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.

OTHER PROJECTS

Global Undergraduate Awards
Dr Ned Nedialkov

September 2021

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
Dr Yasaman Amannejad

June 2020

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

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

[†]Listed in order of proficiency

GRANTS AND AWARDS

NSERC USRA
$ 8120

May 2021 - August 2021

Global Undergraduate Awards
1st Place in North America

September 2020

McMaster Stewart Award
$ 3750

May 2020

CANDEV Data Challenge
1st place in Government of Canada competition

January 2020

STEM Fellowship Big Data Competition
$ 3000

July 2019