

DEXTER BARROWS

CURRICULUM VITAE

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✉ dexter@barrows.io

Education

Doctor of Philosophy – Mathematics

RYERSON UNIVERSITY

2022

Developing new optimisations for techniques designed for the simulation of biochemical reaction-diffusion systems. Focus is on the utilisation of inference schemes to determine optimal parameters for accurate and efficient simulations, and the development of R/C++ software packages to make these enhancements available to practitioners.

THESIS *Efficient stochastic simulation of reaction-diffusion networks*
SUPERVISORS Dr. Silvana Ilie & Dr. Katrin Rohlf

Master of Science – Applied Mathematics

MCMASTER UNIVERSITY

2016

Examined techniques for parameter inference and forecasting of time series, within the context of epidemic forecasting. Developed and utilised massively parallel implementations of iterated particles filters in R/C++/CUDA.

THESIS *A Comparative Study of Techniques for Estimation and Inference of Nonlinear Stochastic Time Series*
SUPERVISOR Dr. Ben Bolker
🔗 <https://github.com/dbarrows/epidemic-forecasting>

Bachelor of Science, with Distinction – Mathematics and Computer Science

RYERSON UNIVERSITY

2014

Created software framework for the simulation of biochemical kinetics, including a novel application of the Multi-level Monte-Carlo method to this domain, in MATLAB/CUDA.

THESIS *Software for Multi-level Monte-Carlo Simulation of Stochastic Biochemical Kinetics*
SUPERVISOR Dr. Silvana Ilie
🔗 <https://github.com/dbarrows/biochemical-kinetics>

Professional Experience

Software Developer

7D SURGICAL

2017–2019

Developed software components for medical embedded systems, with a focus on algorithms for GPU-accelerated 3D image processing and UI design.

LANGUAGES C#, C++
FRAMEWORKS CUDA, WPF

Research Assistant

BIOPHOTONICS AND BIOENGINEERING LABORATORY (BBL)

2015–2017

Designed algorithms for GPU-accelerated medical image processing and semi-automated anatomical segmentation.

LANGUAGES C++, MATLAB
FRAMEWORKS CUDA

Data Analyst

CANADIAN SOCIETY OF ASSOCIATION EXECUTIVES (CSAE)

2013

Performed data sourcing, verification, and analysis.

Teaching Experience***Graduate Assistant***

RYERSON UNIVERSITY

2019–PRESENT

Run tutorials and labs, and invigilate and grade quizzes/tests/exams.

COURSES Numerical Analysis, Linear Algebra

LANGUAGES MATLAB

Teaching Assistant

MCMASTER UNIVERSITY

2014–2016

Ran tutorials and labs, and invigilated and graded tests/exams.

COURSES Introduction to Scientific Computing, Calculus for Life Sciences

LANGUAGES Python

Math and Science Tutor

THE MATH GURU

2010–2014

Taught mathematics, physics, and computer science up to university level.

LANGUAGES Python

Awards***Postgraduate Scholarship – Doctoral (PGS D)***

THE NATIONAL SCIENCE AND ENGINEERING RESEARCH COUNCIL OF CANADA (NSERC)

2020–2023

National scholarship supporting high-calibre scholars who are engaged in doctoral programs in the natural sciences or engineering.

Queen Elizabeth II – Science and Technology (QEII-GSST)

RYERSON UNIVERSITY / THE PROVINCE OF ONTARIO

2019–2020

Provincial merit-based scholarship for students in a graduate research-based programs in a science and technology discipline.

Journal Publications***Optical coherence tomography for dynamic axial correction of an optical end-effector for robot-guided surgical laser ablation***

OPTICAL ENGINEERING

2019

AUTHORS J Jivraj, C Chen, D Barrows, VXD Yang

🔗 <https://doi.org/10.1117/1.OE.58.5.054106>***Optimization of laser osteotomy at 1064 nm using a graphite topical absorber and a nitrogen assist gas jet***

BIOMEDICAL OPTICS EXPRESS

2019

AUTHORS J Jivraj, D Barrows, X Gu, VXD Yang

🔗 <https://doi.org/10.1364/BOE.10.003114>

Conference Presentations

Efficient techniques for inferring stochastic biochemical system reaction rates

CANADIAN APPLIED AND INDUSTRIAL MATHEMATICS SOCIETY (CAIMS) ANNUAL MEETING

2021

AUTHORS D Barrows, S Ilie

Optimal bath particle density selection for Reactive Multiparticle Collision dynamics

CANADIAN APPLIED AND INDUSTRIAL MATHEMATICS SOCIETY (CAIMS) ANNUAL MEETING

2021

AUTHORS D Barrows, K Rohlf

Inference of Stochastic Biochemical System Reaction Rates

INTELLIGENT SYSTEMS FOR MOLECULAR BIOLOGY (ISMB)

2020

AUTHORS D Barrows, S Ilie

A Software Ecosystem for Stochastic Biochemical Network Simulation in R

SIAM/CANADIAN APPLIED AND INDUSTRIAL MATHEMATICS SOCIETY (CAIMS) ANNUAL MEETING

2020

AUTHORS D Barrows, K Rohlf, S Ilie

Graphics processor unit acceleration enables realtime endovascular Doppler optical coherence tomography imaging

SPIE PHOTONICS WEST

2017

AUTHORS D Barrows, B Vuong, K Lee, J Jivraj, VXD Yang

🔗 <https://doi.org/10.1117/12.2254930>

Graphics processor unit acceleration enables realtime endovascular Doppler optical coherence tomography imaging: development and validation

SPIE PHOTONICS WEST

2017

AUTHORS D Barrows, JM Ramjist, B Vuong, K Lee, J Jivraj, VXD Yang

🔗 <https://doi.org/10.1117/12.2256623>

Assessment of haemodynamics of intracranial aneurysms using Doppler optical coherence tomography in patient specific phantoms: preliminary results

SPIE PHOTONICS WEST

2017

AUTHORS JM Ramjist, J Jivraj, D Barrows, B Vuong, R Wong, VXD Yang

🔗 <https://doi.org/10.1117/12.2256532>

Invited Presentations & Trainings

The Stochastic Simulation Algorithm

RYERSON UNIVERSITY, DEPARTMENT OF MATHEMATICS

2021

Inhomogeneous biochemical systems: modelling and stochastic simulation

RYERSON UNIVERSITY, DEPARTMENT OF MATHEMATICS

2020

Biochemical systems: modelling and stochastic simulation

RYERSON UNIVERSITY, DEPARTMENT OF MATHEMATICS

2019

Spatiotemporal models

MCMaster UNIVERSITY, DEPARTMENT OF MATHEMATICS & STATISTICS

2015

Julia sets

MCMaster UNIVERSITY, DEPARTMENT OF MATHEMATICS & STATISTICS

2015

Epidemic forecasting: review of the state of the art

MCMaster UNIVERSITY, DEPARTMENT OF MATHEMATICS & STATISTICS

2015

Fringe: software for OCT data acquisition and imaging

BIOPHOTONICS AND BIOENGINEERING LABORATORY

2016

Git & Github

BIOPHOTONICS AND BIOENGINEERING LABORATORY

2016

Models for systems of biochemical reactions: simulation and software implementation

RYERSON UNIVERSITY, DEPARTMENT OF MATHEMATICS

2014

Software**rendr**

R PACKAGE

2020

An R package for simulating reaction and reaction-diffusion systems.

LANGUAGES R, C++

FRAMEWORKS OpenMP

🔗 <https://dexter.barrows.io/rendr>**mountie**

R PACKAGE

2020

An R package providing an efficient C++ implementation of the Reactive Multi-Particle Collisions (RMPC) algorithm.

LANGUAGES R, C++

FRAMEWORKS OpenMP

🔗 <https://dexter.barrows.io/mountie>**bondr**

R PACKAGE

2020

Provides utilities and classes for working with reaction networks in R.

LANGUAGES R, C++

🔗 <https://dexter.barrows.io/bondr>**wplot**

R PACKAGE

2020

A clean theme for ggplot2 with matching geom defaults.

LANGUAGES R

🔗 <https://dexter.barrows.io/wplot>


Fringe**WINDOWS APPLICATION****2016**

Program for Optical Coherence Tomography (OCT) data acquisition and imaging.

LANGUAGES C++
 FRAMEWORKS CUDA, OpenGL

MARS**MATLAB TOOLKIT****2014**

Toolkit for simulating well-stirred biochemical systems.

LANGUAGES MATLAB
 FRAMEWORKS CUDA
 <https://github.com/dbarrows/biochemical-kinetics/tree/master/code>

Certifications***LBR iiwa – Commissioning and Programming*****KUKA COLLEGE****2017**

Operation and programming of the KUKA LBR iiwa personal robotic assistant, including safe interaction, manual operation, basic maintenance, authoring robotic applications, and debugging.

LANGUAGES Java

Leadership***President, Mathematics Course Union (MCU)*****RYERSON UNIVERSITY****2013–2014**

Acted as a liaison between students, the Department of Mathematics, and the Faculty of Science.

COMMITTEES Curriculum Advising Committee, By-law Revising Subcommittee, Ryerson Science Society (RSS) Steering Committee

Vice President – Financial, Ryerson Science Society (RSS)**RYERSON UNIVERSITY****2012–2013**

Ensured transparent flow of financial resources for student events