DEXTER BARROWS
CURRICULUM VITAE

🔗 dexter.barrows.io
✉ 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 for image-guided surgical navigation of the spine and cranium. Built 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, OpenMP, 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, OpenGL

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 RESEACH 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