DEXTER BARROWS

CV

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✉ dexter@barrows.io

Professional Experience

Research Scientist

NORTHERN DIGITAL INC   2023–PRESENT

Senior Software Developer

7D SURGICAL   2021–2023

Design and implement system software for image-guided surgical navigation.

- Create software features for flagship surgical navigation application
- Develop new applications for navigation of specialized surgical procedures
- Serve as a technical resource for team members, especially on software architecture and design, UI/UX, and code quality
- Onboard, train, and supervise software team members
- Manage the evolution of projects through the software development lifecycle

LANGUAGES   `C#, C++`

FRAMEWORKS   `CUDA, OpenMP, WPF`

Software Developer

7D SURGICAL   2017–2019

Developed software for image-guided surgical navigation of the spine and cranium.

- Worked closely with clinical team members to greatly streamline UX of all clinical applications, leading to improved utility and experience for surgeons
- Designed and implemented cranial biopsy procedure guidance software
- Redesigned application data structuring and handling to enable multiple concurrent workflows in cranial navigation software
- Refined UI of clinical applications in concert with sales and marketing teams
- Improved automated test coverage used in CI/CD system
- Sped up critical image processing pipeline by 50%
- Actively participated in all phases of the software lifecycle in compliance with ISO 13485
- Gave presentations on on software profiling and data processing, WPF layouts, and Git LFS

LANGUAGES   `C#, C++`

FRAMEWORKS   `CUDA, OpenMP, WPF`

Research Assistant

BIOPHOTONICS AND BIOENGINEERING LABORATORY (BBL)   2015–2017

Architected modular software solution for real-time, GPU-accelerated medical image processing for use in a variety of research projects.

- Designed medical image processing pipeline for semi-automated anatomical segmentation
- Developed 3D image-processing tools to aid date processing for major clinical study
- Served as a technical resource on software development methods and practices, and gave presentations on core topics such as codebase analysis and Git

LANGUAGES   `C++, MATLAB`

FRAMEWORKS   `CUDA, OpenGL`

Data Analyst

CANADIAN SOCIETY OF ASSOCIATION EXECUTIVES (CSAE)   2013

Performed data sourcing, verification, and analysis.

Education

Doctor of Philosophy – Mathematics

TORONTO METROPOLITAN UNIVERSITY   TO BE CONFERRED 2025

Developed 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 *Accurate and 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

TORONTO METROPOLITAN 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

Teaching Experience

Graduate Assistant

TORONTO METROPOLITAN 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)
TORONTO METROPOLITAN 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

Parameter estimation for the reaction–diffusion master equation
AIP ADVANCES 2023

AUTHORS   D Barrows, S Ilie

𝒫   https://doi.org/10.1063/5.0150292

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

𝒫   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

𝒫   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

TORONTO METROPOLITAN UNIVERSITY, DEPARTMENT OF MATHEMATICS   2021

Inhomogeneous biochemical systems: modelling and stochastic simulation

TORONTO METROPOLITAN UNIVERSITY, DEPARTMENT OF MATHEMATICS   2020

Biochemical systems: modelling and stochastic simulation

TORONTO METROPOLITAN 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

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)
TORONTO METROPOLITAN 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)
TORONTO METROPOLITAN UNIVERSITY   2012-2013

Ensured transparent flow of financial resources for student events