

Bradley J. Nelson

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Education

Ph.D. Computational and Mathematical Engineering

Stanford University, expected June 2020

Dissertation: Parameterized Topological Data Analysis

Advisor: Gunnar Carlsson, Co-Advisor: Jonathan Taylor

B.A. Mathematics, Dartmouth College, 2013

with High Honors, Summa Cum Laude, Phi Beta Kappa

Minors in Physics and Chemistry

Fellowships and Recognition

National Defense Science and Engineering Graduate Fellowship

US Department of Defense, 2015–2018

Three years of full funding for graduate studies.

Computational Science Graduate Fellowship, Honorable Mention

US Department of Energy, 2015.

Neukom Prize for Outstanding Undergraduate Research in Computational Science

Dartmouth College, 2013.

Cook-Richter award for undergraduate research

Dartmouth College, 2012.

One term of funding for research during off-term.

Scholarly work

SUBMITTED/IN PREPARATION

A Topology Layer for Machine Learning.

Rickard Brüel-Gabrielsson, Bradley J. Nelson, Anjan Dwaraknath, Primoz Skraba, Leonidas J. Guibas, Gunnar Carlsson.

Submitted. arXiv: 1905.12200

Persistent and Zigzag Homology: A Matrix Factorization Viewpoint.

Gunnar Carlsson, Anjan Dwaraknath, Bradley J. Nelson.

In Preparation. arXiv: 1911.10693

Classification of Seismic Image Textures using Persistent Homology.

Bradley J. Nelson, Rahul Sarkar.

In Preparation. (Extending SEP 176 technical report and conference publication.)

Parameterized Topological Data Analysis.

Bradley J. Nelson.

In Preparation. (Dissertation work.)

PEER-REVIEWED PUBLICATIONS

Boundary integral equation solution of high frequency scattering from obstacles in an unbounded linearly graded-index medium.

Alex H. Barnett, Bradley J. Nelson, and J. Matthew Mahoney

Journal of Computational Physics 297C:407-426, 2015.

Chiral Polymerization in Open Systems From Chiral-Selective Reaction Rates.

Marcello Gleiser, Bradley J. Nelson, and Sara Imari Walker

Origins of Life and Evolution of Biospheres 42:333-346, 2012.

CONFERENCE PUBLICATIONS

Texture Based Classification of Seismic Image Patches Using Topological Data Analysis.

Rahul Sarkar, Bradley J. Nelson.

81st EAGE Conference and Exhibition 2019. DOI: 10.3997/2214-4609.201901608.

TECHNICAL REPORTS

Texture Based Classification Of Seismic Image Patches Using Topological Data Analysis.

Rahul Sarkar, Bradley J. Nelson.

SEP 176, 2019.

THESES

Boundary Integral Equations in Linearly Graded Media.

Bradley J. Nelson; Advisor: Alex Barnett.

Dartmouth College Honors Thesis (High Honors in Mathematics). 2013.

Additional Research Experience

Research Assistant, Stanford Linear Accelerator, Jan. – Sept. 2019. Supervised by Kazuhiro Teharo (Neutrino Physics). Assisted in development of deep learning techniques for neutrino detector data (<https://github.com/DeepLearnPhysics>). Led development of graphical neural networks module for particle tracking.

Research Intern, Lawrence Livermore National Laboratory, Summer 2017. Supervised by Geoff Sanders (Graphs Group). Spectral clustering of multi-layer networks. Investigated numerical methods for finding clusters and accelerating convergence in eigenvalue calculations.

Research Intern, Lawrence Livermore National Laboratory, Summer 2016. Supervised by Geoff Sanders (Graphs Group). Developed projection pursuit algorithms for circular structures. Participant in the LLNL Data Sciences Summer Institute.

Undergraduate Research Assistant, Massachusetts Institute of Technology, Summer 2012. Supervised by Prof. Laurent Demanet (Mathematics). Developed Matlab package for quasi-separable matrices.

Industry Experience

Engineering Intern, Ayasdi, Summer 2015. High performance optimizations and parallelization for the mapper algorithm (topological data analysis). Increased performance by orders of magnitude for situations of interest.

Business Intelligence Developer, Epic Systems Corp., July 2013 –June 2014. Developed medical record software for long-term care facilities.

Teaching

STANFORD UNIVERSITY

Instructor of Record Introduction to Scientific Python
Stanford University, Fall 2018.

Course material available: <https://icme.github.io/cme193>

Instructor of Record, Course Creator Libraries for Numerical Linear Algebra and Optimization
Stanford University, Spring 2018. Co-taught and designed with Ron Estrin.

Course material available: <https://github.com/icme/cme258>

Instructor of Record Advanced Topics in Scientific Computing with Julia
Stanford University, Winter 2018.

Course material available: <https://github.com/icme/cme257-advanced-julia>

Instructor of Record, Course Creator Advanced Topics in Scientific Computing with Julia
Stanford University, Fall 2015.

Course material available: <https://github.com/icme/cme257-advanced-julia>

DARTMOUTH COLLEGE

Teaching Assistant (Lab), Organic Chemistry I, Dartmouth College, Spring 2012

Teaching Assistant (Lab), Honors Organic Chemistry II, Dartmouth College, Winter 2012

Teaching Assistant (Lab), Honors Organic Chemistry I, Dartmouth College, Fall 2011

Teaching Assistant (Lab), Organic Chemistry II, Dartmouth College, Summer 2011

MENTORSHIP

Alexander Zlokapa (CalTech Undergraduate), SLAC Summer Student, Summer 2019. Project on clustering methods for neutrino detectors.

ICME First-year Mentor Program, 2017-2019 (two PhD students).

AWARDS AND RECOGNITION

Short Course Instructor Award 2018.

Institute for Computational and Mathematical Engineering, Stanford University

Senior Teaching Fellow 2018 – present.

Institute for Computational and Mathematical Engineering, Stanford University

Status to recognize students with exceptional teaching experience.

Teaching Fellow 2016-2018.

Institute for Computational and Mathematical Engineering, Stanford University

Status to recognize students with significant teaching experience.

Selected Talks

08/2019	AI at SLAC Seminar	SLAC	Menlo Park, CA
10/2018	Data Science Seminar	SLAC	Menlo Park, CA
08/2017	Applied Algebraic Topology	Hokkaido University	Sapporo, Japan
08/2017	Algebraic Geometry	SIAM	Atlanta, GA
08/2016	Data Sci. Summer Inst.	LLNL	Livermore, CA
11/2012	Applied Math Seminar	Dartmouth College	Hanover, NH

Service

Stanford Linear Algebra and Optimization Seminar, Co-organizer, 2019–present

ICME Student Council, 2016–2018

ICME Student Seminar, Co-organizer, 2016–2017

ICME Distinguished Speaker Series, Co-organizer, 2016–2017

Computational Consulting (C²), Stanford University, 2014–present

– Co-president Winter/Spring, 2017

Technical Skills

Programming Languages: C++, Python, Julia, C, Fortran, Matlab, R

HPC Frameworks: MPI, OpenMP

Scientific Computing: BLAS, LAPACK, ArPACK, JuMP, SciPy

Machine Learning/Data Science: PyTorch, pandas, scikit-learn