Benjamin C. Ide

Summary

I am an applied mathematician with experience in mathematical modeling, optimization, differential equations, and numerical implementations thereof. I'm also familiar with algebraic topology and category theory and have a doctoral minor in algebraic topology.

Education

- August 2022 Ph.D., Mathematics, Georgia Institute of Technology Focused on applied mathematics and mathematical modeling with a minor in algebraic topology.
 - May 2012 B.S., Mathematics, Concord University, summa cum laude

Research

2017–2023 **DDE Model of the Germinal Center Reaction**, paper in preparation I created a delay differential equation model of the germinal center reaction (the immunological process through which B cell affinity maturation occurs). We propose an additional mechanism of antibody feedback with support from our *in silico* experiments.

2019–2020 The Inradius Problem via SSMILE

Using the SSMILE algorithm, I gave numerical evidence that Zalgaller's conjectured solution to the in-radius problem is exactly correct.

2016–2019 Surface Surveillance via Minimum Length Paths (SSMILE)

I developed a numerical algorithm to survey surfaces via minimum length paths. This work includes the use of global optimization via intermittent diffusion and PDE accelerated gradient descent.

Software and Technology

 $Github\ link\ GrayCodeIterator.jl,\ developer$

Provides a fast iterator over all binary vectors of a user-provided length and weight. This is used in minimumdistance() in CodingTheory.

Github link CodingTheory, initial co-developer with Eric Sabo Julia coding theory library built around the Oscar.jl framework with the goal of implementing both classical and quantum error-correcting codes without relying on external packages such as GAP.

Github link Germinal Center DDE Model (GC-DDE), developer Implementation of the model I developed to study B cell affinity maturation. This repository is set to private until the paper is submitted for publication.

Github link Inradius.jl, developer Numerical solver for the shortest path of inradius 1 in \mathbb{R}^3 . This has provided numerical evidence in favor of the Zalgaller conjecture.

- Julia language (advanced)
- LATEX (advanced)
- git, Github, Github Actions
- o SQL
- o command line tools (grep, sed, awk, jq, sqlite3, etc.)

Work Experience

- $2019-2020 \quad \textbf{Researcher}, \ Emory \ University, \ Department \ of \ Microbiology \ and \ Immunology$
- $2018-2019 \ \ {\bf Real \ Analysis}, \ Spelman \ College$

Talks

- May 2022 A Novel Delay Differential Equation Model of the Germinal Center Reaction and an Algorithm for Minimum Length Surveillance Paths (Ph.D. thesis defense)
- Fall 2019 Using Numerical Optimization Techniques to Solve Classical Geometry Problems
- Spring 2015 Regularity and Radiality of Solutions to the Ground State Equation
- Spring 2015 Applying Obstruction Theory to Prove the Hopf-Whitney Theorem

Teaching Experience

- As the TA for CETL 8000, I helped teach pedagogy to new TAs.
- During the IMPACT REU, I taught a I^AT_EX minicourse and advised students on projects modeling the life cycle of the disease schistosomiasis and in modeling polutant deposition via river dynamics.

| Courses taught | | | |
|----------------|------------|-------------------------|----------|
| Semester | Role | Course | Students |
| Spring 2019 | Head TA | Differential Equations | 30 |
| Fall 2018 | Head TA | Differential Equations | 29 |
| Spring 2018 | Instructor | Differential Equations | 90 |
| Fall 2017 | ТА | CETL 8000 | 25 |
| Fall 2017 | ТА | Honors Linear Algebra | 29 |
| Summer 2017 | Instructor | Intro to Linear Algebra | 68 |
| Spring 2017 | Instructor | Differential Equations | 96 |
| Fall 2016 | Instructor | Survey of Calculus | 102 |
| Summer 2016 | Instructor | Differential Equations | 24 |
| Fall 2015 | TA | Differential Equations | 70 |
| Summer 2015 | ТА | IMPACT REU | 6 |
| Spring 2015 | ТА | Differential Equations | 15 |
| Fall 2014 | ТА | Differential Equations | 31 |
| Summer 2014 | ТА | Calculus II | 28 |
| Spring 2014 | TA | Calculus III | 33 |
| Fall 2013 | TA | Calculus III | 33 |
| Spring 2013 | TA | Calculus I | 70 |
| Fall 2012 | TA | Calculus I | 70 |

Organizational Experience

- 2018 2019 Created and organized the Applied and Computational Mathematics Student Working Seminar; garnered a group of regular attendees.
- 2017 2018 Worked 4 conferences in the School of Mathematics at Georgia Institute of Technology
 - 2017 Organized a working group to study the mathematics of deep learning
- 2014 2015 Organizer for the weekly Research Horizons seminar

Honors and Awards

- 2017 2018 Graduate Teaching Assistant of the Year, Georgia Institute of Technology
- 2013 2015 $\,$ NSF S-STEM Fellowship, Georgia Institute of Technology
- 2010 Bruce Covey Mathematics Prize, Concord University
- 2008 2012 Scholar of Distinction, Concord University