Jacob Elafandi | Curriculum Vitae

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EDUCATION

University of California, Berkeley August 2019 – Present
Ph.D. in Mathematics (expected graduation May 2026)

- GPA (4.00 scale): 3.87
- Advisor: Professor Franziska Weber

University of Minnesota, Twin Cities September 2015 – May 2019
B.S. in Mathematics
B.S. in Computer Science

- GPA (4.00 scale): 3.90
- Graduated *summa cum laude* with High Distinction
- Thesis: *Edge Detection on Bone Fragment Scans*
- Advisor: Professor Jeff Calder

PUBLICATIONS

[1] J. Elafandi and F. Weber. Finite element analysis of a nematic liquid crystal Landau-de Gennes model with quartic elastic terms. Submitted to *SIAM Journal on Numerical Analysis*. arXiv:2409.09837.

RESEARCH AND INDUSTRIAL EXPERIENCE

Algorithm Development (Quantitative Research) Ph.D. Internship May 2025 – August 2025
Hudson River Trading *New York, NY*

- Applied data and formulae for stock options to accurately price derivatives of the VIX index, constructing a signal to be used for trading
- Constructed machine learning models to predict daily notional traded for US stocks, so as to inform estimates of market impact and trading costs
- Devised a profitable trading strategy for a simulated stock with a stream of pseudorandom alpha signals
- Gained experience with software and libraries commonly used in the industry
- Engaged in daily seminars to learn and discuss the intricacies of the financial system

Numerical Q-Tensor Models of Nematic Liquid Crystals May 2023 – Present
Student researcher advised by Prof. Franziska Weber (UC Berkeley) *Berkeley, CA*

- Studied properties of liquid crystals and models of their elastic and thermotropic energy
- Derived a finite element discretization of a fourth-order Landau-de Gennes Q-tensor model
- Rigorously proved that this model converges to the continuous case and is therefore useful for predicting physical phenomena
- Coded and tested this model, heavily optimized its runtime, and analyzed its performance on sample liquid crystal configurations

Algorithmic Improvements to Slurm Workload Manager May 2020 – December 2022
Research assistant under Dr. Douglas Jacobsen (Lawrence Berkeley National Laboratory) *Berkeley, CA*

- Worked in the Computational Systems Group at the National Energy Research Scientific Computing Center
- Assisted in scheduling and optimizing project flow on the Cori supercomputer
- Designed and implemented algorithm that bundled smaller jobs to run efficiently during gaps between large jobs, significantly reducing queue times for smaller jobs while maintaining overall throughput
- Communicated regularly with high-volume users to understand their computing needs and incorporate them into the bundling algorithm
- Tailored algorithm to be compatible with a labyrinthine network of dependencies, but also made it highly modular and adaptable, so that future developers can easily reintegrate it should those dependencies change

Simulation of Erosion on Bone Fragments April 2022 - November 2022
Independent research in conjunction with Prof. Jeff Calder and Prof. Per-Olof Persson *Berkeley, CA*

- Implemented a curvature-based fairing algorithm to gradually reduce the volume of a triangular mesh and smooth out any sharp edges
- Collaborated with other researchers performing erosion of physical bone fragments to ensure that this model accurately described such an erosion process

Edge Detection on Bone Fragment Scans September 2018 – May 2019
Student research assistant advised by Prof. Jeff Calder (University of Minnesota) *Minneapolis, MN*

- Designed and implemented a modified Dijkstra algorithm to identify edges of breakage on triangular meshes derived from bone fragments
- Identified several different curvature-based thresholding strategies that gave desirable results on different scans, and made program configurable so that users can easily choose the best strategy for each fragment
- Conferred with a consortium of mathematicians and anthropologists to identify parameters of success and discuss applications, most notably a machine learning-based classification system to identify the cause of breakage from patterns in detected edges
- Presented findings as both a thesis and a live talk in a clear, concise, yet detailed style

Kernel Interface Development at Cray Inc. May 2018 – August 2018; May 2019 – August 2019
Software development intern *Bloomington, MN*

- Transferred kernel interfaces from obsolete virtual file systems through editing underlying object structure
- Modified build scripts and C source code to enable tracking of all allocated memory
- Wrote a file system layer to intercept and handle system calls to enable easier debugging of large-scale programs, and added substantial functionality, including individual configuration of system calls and the ability to stress test by inducing artificial delays or errors
- Extensively documented code in an intuitive, comprehensible way to make it easy for future developers to understand and modify

Cryogenic Dark Matter Search November 2016 – April 2017
Student research assistant advised by Prof. Vuk Mandić (University of Minnesota) *Minneapolis, MN*

- Operated a dilution refrigerator by using liquid nitrogen and liquid helium to cool germanium detectors to temperatures of under 20 mK
- Designed 3D models of machine components in Autodesk Inventor for use in presentations and laboratory simulations

LEADERSHIP AND TEACHING EXPERIENCE

UC Berkeley Mathematics Directed Reading Program February 2024 – Present
Graduate student advisor *Berkeley, CA*

- Host weekly discussions with an undergraduate student to collaboratively work through an advanced textbook related to that student's academic interests
- Answer curricular questions, provide mentoring support, and serve as a window into the life of a graduate student

UC Berkeley Department of Mathematics August 2019 – May 2020; January 2023 – Present
Graduate student instructor *Berkeley, CA*

- Courses: Calculus (Fall 2019, Spring 2020, Fall 2023, Summer 2024); Methods of Mathematical Optimization (Spring 2023, Fall 2024); Numerical Solutions of Differential Equations (Fall 2023); Discrete Mathematics (Spring 2024, Fall 2025); Numerical Analysis (Spring 2025)
- As head instructor, prepared concise yet detailed slides and presented them in daily lectures, oversaw grading of homework, and wrote, proctored, and graded exams (Summer 2024)
- Manage discussion sections, create worksheets, and hold office hours to assist students in material comprehension
- Administer and grade quizzes, grade homework assignments, and answer students' questions remotely throughout semester

UC Berkeley Mathematics Graduate Student Association February 2022 – February 2025
Elected board member *Berkeley, CA*

- Organized and facilitated weekly tea socials, department-wide parties, open house, and other activities intended to foster community spirit
- As finance officer, allocated funds in yearly budget and ensured smooth processing of reimbursement requests
- Oversaw merchandise stock and assured smooth and rapid delivery
- Provided technical support for elections, office draw, and website maintenance

Berkeley Math Tournament April 2024
Volunteer administrator *Berkeley, CA*

- Conducted a competition for preteen mathematicians, ensuring clean delivery of instructions and supplies
- Maintained both order and a welcoming environment while proctoring a group exam for 30+ middle school students

University of Minnesota Department of Computer Science & Engineering January 2018 – May 2019
Teaching assistant *Minneapolis, MN*

- Courses: Machine Architecture and Organization (Spring 2018, Spring 2019); Advanced Programming Principles (Fall 2018)
- Hosted office hours to answer questions, graded projects and other assignments, and administered and graded exams
- Evaluated thousands of lines of code to pinpoint errors and guide students toward better programming practices

University of Minnesota Honors Program September 2016 – May 2019
Calculus tutor *Minneapolis, MN*

- Led weekly review sessions for Honors Calculus 2, 3, and 4 students to improve course performance and material comprehension
- Provided group and one-on-one assistance with homework assignments and exam preparation

University of Minnesota Honors Program September 2016 – December 2016
Peer mentor *Minneapolis, MN*

- Held monthly one-on-one meetings with new students to ease the transition into university life and help them find a sense of community
- Provided emotional support, addressed mentees' questions and concerns, and served as a resource for finding other means of support

TALKS AND PRESENTATIONS

- "Predicting Volume of US Equities" August 2025
  Poster presentation, Hudson River Trading
- "Trading VIX Futures" July 2025
  Poster presentation, Hudson River Trading
- "Numerical Q-Tensor Models of Nematic Liquid Crystals" January 2025
  2025 Joint Mathematics Meetings
- "Numerical Q-Tensor Models of Nematic Liquid Crystals" April 2024
  Applied Partial Differential Equations Seminar, UC Berkeley
- "Numerical Q-Tensor Models of Nematic Liquid Crystals" September 2023
  Computational Mathematics Seminar, UC Berkeley
- "A Custom File System Layer for Analyzing Performance of System Calls" August 2019
  Poster presentation, Cray Inc.
- "Edge Detection on Bone Fragment Scans" May 2019
  Thesis defense, University of Minnesota
- "Migration of procfs interfaces to sysfs and debugfs" August 2018
  Poster presentation, Cray Inc.

SCHOLARSHIPS, HONORS, AND COMPETITIONS

- Project Euler: 710+ problems solved (top 200 worldwide) October 2014 – Present
  Independent mathematical pursuit
- Winner of the Jane Street GUTS++ Competition October 2024
  Jane Street Capital
- Second Place in the DTCC Code-A-Thon October 2023
  Depository Trust & Clearing Corporation
- Winner of the SIG × Berkeley Brainteaser Battle March 2022
  Susquehanna International Group
- Finalist in the UC Berkeley Integration Bee January 2020
  Event for students in mathematics, physics, and engineering
- Outstanding Graduate in Mathematics May 2019
  University of Minnesota Department of Mathematics
- Prof. Hans H. Dalaker Scholarship September 2018 – May 2019
  University of Minnesota Department of Mathematics
- University Honors Program Member September 2015 – May 2019
  University of Minnesota
- Eight-time Dean's List honoree September 2015 – May 2019
  University of Minnesota College of Science and Engineering
- Presidential Scholarship September 2015 – May 2019
  University of Minnesota

- Gold Scholar Award — September 2015 – May 2019
  University of Minnesota

PROFESSIONAL MEMBERSHIPS

- American Mathematical Society
- Society for Industrial and Applied Mathematics

TECHNICAL SKILLS

- Numerical computing (Python, including pandas and NumPy; C/C++; MATLAB; Julia; Mathematica)
- Version control (git)
- Documenting results (LaTeX; Microsoft Office; Markdown)
- Familiar and comfortable with development in Windows, macOS, and Linux