

Mara Downing

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<https://maradowning.com>

Education

University of California, Santa Barbara, PhD in Computer Science December 2025

- Dissertation: Quantitative Neural Network Testing and Verification
- Research Advisor: Tevfik Bultan
- Committee: Michael Beyeler, Yu Feng, Yufei Ding

University of California, Santa Barbara, MS in Computer Science March 2025

Harvey Mudd College, BS in Computer Science May 2020

Teaching Interests

Universal Design for Learning; Radical Compassion; **Subjects:** Software Verification and Testing, Artificial Intelligence, Artificial Intelligence Testing and Verification, Compilers, Introductory Programming, Data Structures

Research Interests

Robustness, Safety, and Fairness of Artificial Intelligence; Verification of Medical AI Systems; Formal Verification; Automated Testing; Software Engineering; Ethics of AI in Practice

Teaching Experience

Instructor of Record, University of California Santa Barbara Summer 2024

- Taught the *Problem Solving in Computer Science I* course to 24 students (this course introduces C++, covering the basics of syntax through pointers, file I/O, classes, and recursion).
- Prepared and presented two 75-minute lectures per week, and held 4 hours of office hours per week.
- Managed 3 TAs who assisted in assignment preparation and grading and led weekly labs.
- More information on course structure and student feedback on my website: <https://maradowning.com>.

Instructor of Record, University of California Santa Barbara Summer 2022

- Taught the *Problem Solving in Computer Science I* course to 64 students.
- Prepared and presented three 50-minute lectures per week, and held 4 hours of office hours per week.
- Managed 3 TAs who assisted in assignment preparation and grading and led weekly labs.
- More information on course structure and student feedback on my website: <https://maradowning.com>.

Teaching Assistant, University of California Santa Barbara Fall 2020–Spring 2021

- Held office hours and led discussion sections for three quarters of CS156: Advanced Applications Programming.
- Created assignments, reviewed student code, and graded final code submissions.

HMC Clinic Team Member, Harvey Mudd College Fall 2019–Spring 2020

- Worked on a team to revamp curriculum based on student feedback for Google’s Applied Machine Learning Intensive course.
- Created slides and Google Colab notebooks to teach introductory Python concepts.

Tutor/Grader, Harvey Mudd College Spring 2017–Spring 2020

- Tutored and graded students of all grade levels in multiple computer science courses:
 - Principles of Computer Science (Spring 2017, Fall 2017)
 - Data Structures and Program Development (Spring 2018)
 - Computer Systems (Fall 2018, Spring 2019)
 - Computer Networks (Fall 2019)
 - Software Verification (Spring 2020)

Education Team Intern, Code.org Summer 2016, Summer 2017

- Worked on a team to create a new elementary school curriculum for Code.org.
- Reviewed, debugged, and polished coding puzzles for K–5 students.

Software Intern, Oregon State University Summer 2014

- Developed a program using Perl, Bash, and R to parse data from an online learning management system and produce summary graphs for instructors.

Mentoring Experience

ERSP Research Mentor, University of California Santa Barbara Fall 2021–Spring 2022

- Mentored 3 undergraduate computer science students in a year-long research project to measure the effectiveness of brute-force enumeration for quantized neural network robustness verification.
 - Introduced mentees to my in-progress research project to verify neural networks.
 - Guided mentees through self-study on neural network computations and symbolic execution.
 - Supervised mentees through adding code to the existing verifier for input constraint file reading and concrete execution of inputs.
- Involved mentees as coauthors on a peer-reviewed publication: Quantitative Symbolic Robustness Verification for Quantized Neural Networks.

Professional Development in Teaching

Certificate of College and University Teaching Spring 2025

College and University Teaching – From Theory to Practice Spring 2023

Pillars of TAship Certificate Fall 2020

Reading:

- The Courage to Teach by Parker J Palmer
- Teaching College by Norman Eng, Ed.D.

Publications (Peer Reviewed)

Full papers available on my webpage: <https://maradowning.com>

A * indicates a student I directly supervised.

Mara Downing, Matthew Peng, Jacob Granley, Michael Beyeler, Tevfik Bultan, **Fuzzing the Brain: Discovering Safety Violations in ML-Driven Neurotechnology**, Journal of Neural Engineering, 2026.

Laboni Sarker, Mara Downing, Achintya Desai, and Tevfik Bultan, **Assessing, Exploiting, and Mitigating Syntactic Robustness Failures in LLM-Based Code Generation** In AI Foundation Models and Software Engineering (FORGE), Rio de Janeiro, Brazil, April 12–13, 2026.

Mara Downing, Tevfik Bultan, **Black-Box Multi-Robustness Testing for Neural Networks**. In the International Conference on Software Testing (ICST) '25, ser. SAFE-ML Workshop 2025, Naples, Italy, March 31–April 4, 2025.

Mara Downing, William Eiers, Erin DeLong*, Anushka Lodha*, Brian Ozawa Burns*, Ismet Burak Kadron, Tevfik Bultan, **Quantitative Symbolic Robustness Verification for Quantized Neural Networks** In the International Conference on Formal Engineering Methods (ICFEM) '24, Hiroshima, Japan, December 2–6, 2024.

Mara Downing, Tevfik Bultan, **The Case for Scalable Quantitative Neural Network Analysis** In Foundations of Software Engineering (FSE) '23, ser. SE4SafeML Workshop 2023, San Francisco, CA, USA, December 4–7, 2023.

Mara Downing, **Quantitative Robustness Analysis of Neural Networks**. In International Symposium on Software Testing and Analysis (ISSTA) Doctoral Symposium 2023, Seattle, WA, USA, July 17–20, 2023.

Seemanta Saha, Mara Downing, Tegan Brennan, and Tevfik Bultan, **PReach: A Heuristic for Probabilistic Reachability to Identify Hard to Reach Statements**. In 44th International Conference on Software Engineering, ICSE 2022, Pittsburgh, PA, USA, May 25–27, 2022, pages 1706–1717.

Lawrence Lim, Wei-Yee Goh, Mara Downing, and Misha Sra. **A Spatial Music Listening Experience in Augmented Reality**. In UIST '21: The Adjunct Publication of the 34th Annual ACM Symposium on User Interface Software and Technology, Virtual Event, USA, October 10–14, 2021, pages 23–25. ACM 2021.

Abtin Molavi, Mara Downing, Tommy Schneider, and Lucas Bang. **MCBAT: A Practical Tool for Model Counting Constraints on Bounded Integer Arrays**. In ESEC/FSE '20: 28th ACM Joint European Software Engineering Conference and Symposium on the Foundations of Software Engineering, Virtual Event, USA, November 8-13, 2020, pages 1596–1600. ACM, 2020.

Abtin Molavi, Tommy Schneider, Mara Downing, and Lucas Bang. **MCBAT: Model Counting for Constraints over Bounded Integer Arrays**. Verified Software: Theories, Tools, and Experiments (VSTTE) 2020, Los Angeles, CA, USA, July 20–21, 2020. Springer, 2020.

Mara Downing, Abtin Molavi, and Lucas Bang. **Symbolic Execution + Model Counting + Entropy Maximization = Automatic Search Synthesis**. In Proceedings 11th International Symposium on Games, Automata, Logics, and Formal Verification, GandALF 2020, Brussels, Belgium, September 21–22, 2020, volume 326 of EPTCS, pages 50–65, 2020.

Mara Downing, Chris Thompson, and Lucas Bang. **Strategy Synthesis for Deduction Games**. Conference on Artificial Intelligence and Interactive Digital Entertainment (AIIDE) Workshop on Artificial Intelligence for Strategy Games, 2019.

Shannon Collier, Mara Downing. **A Qualitative Analysis of Students' Understanding of Conditional Control Structures**. In Proceedings of the 50th ACM Technical Symposium on Computer Science Education, SIGCSE 2019, Minneapolis, MN, USA, February 27–March 02, 2019, page 1293. ACM 2019.

Software Tools

Fuzzer for Safety of Visual Prostheses: Measures the number and diversity of safety violations in machine learning encoder models for visual prostheses

Relevant Publication: Fuzzing the Brain: Discovering Safety Violations in ML-Driven Neurotechnology

MuL₂: Measures the robustness of multiple correctly classified inputs to a neural network simultaneously

Relevant Publication: Black-Box Multi-Robustness Testing for Neural Networks

VerQ²: Quantifies the robustness of quantized neural networks symbolically, providing sound robustness results.

Relevant Publication: Quantitative Symbolic Robustness Verification for Quantized Neural Networks

Conference Presentations

Presenter (Workshop Paper) at SAFE-ML Workshop at the International Conference on Software Testing (ICST) 2025 in Naples, Italy

Presenter (Research Paper) at the International Conference on Formal Engineering Methods (ICFEM) 2024 in Hiroshima, Japan

Presenter (Workshop Paper) at SE4SafeML Workshop at Foundations of Software Engineering (FSE) 2023 in San Francisco, CA, USA

Presenter (Doctoral Symposium Paper) at International Symposium on Software Testing and Analysis (ISSTA) 2023 in Seattle, WA, USA

Co-Presenter (Poster Associated with Research Paper) at International Conference on Software Engineering (ICSE) 2022 in Pittsburgh, PA, USA

Presenter (Research Paper) at the International Symposium on Games, Automata, Logics, and Formal Verification (GandALF) 2020 in Brussels, Belgium (Virtual)

Presenter (Workshop Paper) at Conference on Artificial Intelligence and Interactive Digital Entertainment (AIIDE) Workshop on Artificial Intelligence for Strategy Games 2019 in Atlanta, GA, USA

Co-Presenter (Poster) at the ACM Technical Symposium on Computer Science Education (SIGCSE) 2019 in Minneapolis, MN, USA

Professional Service

Served on the Program Committee for the Symposium on Software Fault Prevention, Verification, and Validation (SFPVV) 2025

Presented Research to Lockheed Martin's Lunchtime Seminar Series November 2024

Presented Research with WiCS to Santa Susana High School Students November 2023

Co-Reviewed Conference Papers in: International Conference on Software Engineering (ICSE) 2026, 2025, 2024; Automated Software Engineering (ASE) 2025, 2024; International Symposium on Software Testing and Analysis (ISSTA) 2024, 2021; Foundations of Software Engineering (FSE) 2024; NASA Formal Methods (NFM) 2024; Computer Aided Verification (CAV) 2021

Public Service

Event Planner and Coordinator for Nonprofit Brawlin' Betties Roller Derby 2024–Present

Operations Manager for Nonprofit Peninsula Roller Derby 2026–Present

Awards

Don Chamberlain Computer Science Research Award 2020