

EMILY FIRST
Postdoctoral Researcher at UCSD
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I am interested in leveraging *AI for theorem proving* as a playground for exploring how AI can reason better, and in turn, how humans can use AI to reason better themselves in a variety of domains. I am an interdisciplinary researcher, working at the intersection of *machine learning*, *software engineering*, and *programming languages*.

EDUCATION

University of Massachusetts, Amherst, MA September 2017-May 2023
PhD (May 2023), *MS* (May 2020), *Computer Science*
Advisor: Prof. Yuriy Brun
• GPA 3.97

Harvey Mudd College, Claremont, CA September 2013-May 2017
B.S., Joint Major in Computer Science and Mathematics
Humanities Concentration in Economics
• GPA 3.5
• Graduated with Distinction

HONORS & AWARDS

- UMass Amherst CICS 2022-2023 Outstanding Dissertation Award
- ACM SIGSOFT Distinguished Paper Award at ESEC/FSE 2023
- ACM SIGSOFT Distinguished Paper Award at ICSE 2022
- Jim Gray Computer Science Fellowship (2017)
- Wing and Ellen Tam Software Development Award (2016)

WORK EXPERIENCE

Postdoctoral Researcher, UC San Diego CSE, San Diego, CA July 2023 - Present
My postdoc advisor is Prof. Sorin Lerner. My research is focused on automated theorem proving using LLMs through fine-tuning, prompt engineering, and neuro-symbolic techniques.

Research Assistant, UMass CICS, Amherst, MA September 2017- May 2023
My research was focused on automatic synthesis of Coq and Isabelle proof scripts and tool creation for developers using language models.

Student Researcher, Google, Mountain View, CA May 2022-October 2022
I worked with the N2Formal team on proof synthesis and repair in Isabelle using LLMs.

Teaching Assistant, UMass CICS, Amherst, MA Fall 2021

I was a TA for COMPSCI 220 Programming Methodologies, a sophomore-level course in JavaScript.

Research Intern, Raytheon, Woburn, MA May 2019-March 2020

I worked on multiple NLP projects. The main project was predicting the quality of radar runs using error logs. I also worked on using NLP to predict fixes for bug reports.

Consultant Intern, West Monroe Partners, Chicago, IL Summer 2016

I developed features for two iOS apps, debugged legacy code, and performed QA.

Undergraduate Research Assistant, Harvard University, Cambridge, MA Summer 2015

I worked on research on creating a multithreaded translation layer for SMR Drives, which are different from regular hard drives in that they have overlapping tracks, allowing for more data storage but slower write speeds.

PEER-REVIEWED FULL-LENGTH RESEARCH PUBLICATIONS

Robert Thompson, Nuno Saavedra, Pedro Carrott, Kevin Fisher, Alex Sanchez-Stern, Yuriy Brun, João F. Ferreira, Sorin Lerner, **Emily First**

Rango: Adaptive Retrieval-Augmented Proving for Automated Software Verification

In *Proceedings of the 47th International Conference on Software Engineering*
ICSE 2025

Chenyang An, Zhibo Chen, Qihao Ye, **Emily First**, Letian Peng, Jiayun Zhang, Zihan Wang, Sorin Lerner, Jingbo Shang

Learn from Failure: Fine-Tuning LLMs with Trial-and-Error Data for Intuitionistic Propositional Logic Proving

In *Proceedings of the 62nd Annual Meeting of the Association for Computational Linguistics*
ACL Main 2024

Emily First, Markus N. Rabe, Talia Ringer, Yuriy Brun.

Baldur: Whole-Proof Generation and Repair with Large Language Models

In *Proceedings of the 30th ACM Joint European Software Engineering Conference and Symposium on the Foundations of Software Engineering*
ESEC/FSE 2023

ACM SIGSOFT Distinguished Paper Award 🏆

Alex Sanchez-Stern*, **Emily First***, Timothy Zhou, Zhanna Kaufman, Yuriy Brun, Talia Ringer.

Passport: Improving Automated Formal Verification Using Identifiers (*Co-first authors)

In *ACM Transactions on Programming Languages and Systems*
TOPLAS 2023

(Presented as a journal-first paper at PLDI 2023)

Emily First, Yuriy Brun.

Diversity-Driven Automated Formal Verification

In *Proceedings of the 44th International Conference on Software Engineering*
ICSE 2022

ACM SIGSOFT Distinguished Paper Award 🏆

Emily First, Yuriy Brun, Arjun Guha.

TacTok: Semantics-Aware Proof Synthesis

In Proceedings of the ACM on Programming Languages (PACMPL) Object-Oriented Programming, Systems, Languages, and Applications
OOPSLA 2020

PREPRINTS

Saketh Ram Kasibatla, Arpan Agarwal, Yuriy Brun, Sorin Lerner, Talia Ringer, **Emily First**
Cobblestone: Iterative Automation for Formal Verification

arXiv 2024

Under Submission

PEER-REVIEWED DEMO-TRACK PUBLICATIONS

Pedro Carrott, Nuno Saavedra, Kyle Thompson, Sorin Lerner, João F. Ferreira, **Emily First**
CoqPyT: Proof Navigation in Python in the Era of LLMs

In Proceedings of Demonstrations Track at the 32nd ACM International Conference on the Foundations of Software Engineering
FSE 2024

Arpan Agrawal, **Emily First**, Zhanna Kaufman, Tom Reichel, Shizhuo Zhang, Timothy Zhou, Alex Sanchez-Stern, Talia Ringer, Yuriy Brun.

Proofster: Automated Formal Verification

In Proceedings of the Demonstrations Track at the 45th International Conference on Software Engineering
ICSE 2023

PEER-REVIEWED WORKSHOP PUBLICATIONS

Sólrún Einarsson, Yousef Alhessi, **Emily First**, Moa Johansson

On Lemma Conjecturing using Neural, Symbolic and Neuro-symbolic approaches

In 9th Conference on Artificial Intelligence and Theorem Proving
AITP 2024

Shizhuo Dylan Zhang, **Emily First**, Talia Ringer

Getting More out of Large Language Models for Proofs

In 8th Conference on Artificial Intelligence and Theorem Proving
AITP 2023

COMMITTEE SERVICE

- OOPSLA 2025 Review Committee Member
- ICSE 2025 Program Committee Member
- Coq Workshop 2022 Program Committee Member

ORGANIZING

- Student Mentoring Workshop @ ICSE 2024
- Tutorial on Machine Learning for Theorem Proving @ NeurIPS 2023

INVITED TALKS

- Mediterranean Machine Learning (M2L) Summer School 2024
 - Talk title: Machine Learning for Theorem Proving
- Large Language Models for Mathematics and Programming Workshop @ Chalmers University of Technology (August 2024)
 - Talk title: Machine Learning for Theorem Proving Using Trial-and-Error
- Lecture for Discrete Mathematics course @ Fordham University (April 2024)
 - Talk title: Machine Learning for Formal Software Verification
- Computational Cybersecurity in Compromised Environments (C3E) 2023
 - Talk title: LLMs for Formal Proofs