EMILY FIRST

Assistant Professor at Rutgers University, Department of Computer Science

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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

- Distinguished Reviewer Award at OOPSLA 2025
- ACM SIGSOFT Distinguished Paper Award at ICSE 2025
- 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

Assistant Professor, Rutgers University, New Brunswick, NJ — September 2025 - Present

Visiting Researcher, INESC TEC, Porto, Portugal — May 2026 - July 2026

Postdoctoral Researcher, UC San Diego CSE, San Diego, CA — July 2023 - July 2025

My postdoc advisor was 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 PhD advisor was Prof. Yuriy Brun. 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

Saketh Ram Kasibatla, Arpan Agarwal, Yuriy Brun, Sorin Lerner, Talia Ringer, **Emily First**
Cobblestone: Iterative Automation for Formal Verification
In *Proceedings of the 48th International Conference on Software Engineering*
ICSE 2026

Zhanna Kaufman, **Emily First**, Alex Sanchez-Stern, Robert Thompson, Sorin Lerner, Yuriy Brun
ProofCoop: Collaborative Automated Formal Verification
In *Proceedings of the 48th International Conference on Software Engineering*
ICSE 2026

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
ACM SIGSOFT Distinguished Paper Award 🏆

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

Yousef Alhessi, Sólrún Halla Einarsdóttir, George Granberry, **Emily First**, Moa Johansson, Sorin Lerner, Nicholas Smallbone
Lemmanaid: Neuro-Symbolic Lemma Conjecturing
arXiv 2025
Under Submission (also presented at the ICML 2025 AI4Math workshop)

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 Einarsdóttir, 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 2027 Review Committee Member
- ICSE 2027 Program Committee Member
- ASE 2026 Program Committee Member
- Rocq Workshop 2026 Program Committee Member
- ICSE 2026 Program Committee Member
- OOPSLA 2025 Review Committee Member
- ICSE 2025 Program Committee Member
- Coq Workshop 2022 Program Committee Member

JOURNAL SERVICE

- Editor for Journal of Mathematics and Artificial Intelligence (JMAI)
- TOSEM 2025 Reviewer
- JSS 2025 Reviewer

ORGANIZING

- TrustedSoftwAIr'27: International Workshop on Building Trusted Software with AI @ ICSE 2027
- AI and Math Weekly Seminar @ Rutgers University (Fall 2025 - Present)
- Student Mentoring Workshop @ ICSE 2024
- Tutorial on Machine Learning for Theorem Proving @ NeurIPS 2023

TEACHING

- CS 431 Software Engineering (Spring 2026)

FUNDING

- Rutgers SAS Opportunity Award, Co-PI, $70,000
  Toward a True Brain Age: Integrating Proteomics and Machine Learning to Measure Brain Health

INVITED TALKS

- AI4Math Workshop @ ICML 2026
  - Talk title: Model Diversity for Theorem Proving, Lemma Conjecturing, and

Algorithmic Reasoning

- CHAIR Workshop @ Chalmers University (May 2026)
  - Talk title: Model Diversity in Theorem Proving and Recursive Tasks
- NDIST 2025 Workshop
  - Talk title: Automated Formal Verification
- Cornell UT SE Seminar (October 2025)
  - Talk title: Machine Learning for Formal Software Verification
- VerifAI Workshop @ ICLR 2025
  - Talk title: ML for Automating Formal Software Verification in Proof Assistants
- Mediterranean Machine Learning (M2L) Summer School 2024
  - Talk title: Machine Learning for Theorem Proving
- Large Language Models for Mathematics and Programming Workshop @ Chalmers University (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