Mike (Deyuan) He

✉ mikehe@princeton.edu · in @Mike He ⚲ cs.princeton.edu/~dh7120

🏛 Education

Princeton University, Princeton, NJ   2022 – Est. 2027
Ph.D. in Computer Science
M.A. in Computer Science (conferred in May. 2024)
Advisor: Prof. Aarti Gupta
Fields of study: Programming Languages; Formal Methods; Distributed and Agentic Systems

University of Washington, Seattle, WA   2018 – 2022
B.S. in Computer Science, GPA: 3.89/4.0 (Cum Laude)
Advisors: Prof. Zachary Tatlock & Dr. Steven Lyubomirsky
Selected Honor: CRA Outstanding Undergraduate Researcher Award, Honorable Mention (2022)

📖 Selected Publications (By Topics)

Formal Methods for Systems

- **Mike He**, Ankush Desai, Aishwarya Jagarapu, Doug Terry, Sharad Malik, and Aarti Gupta. PInfer: Learning specifications for distributed systems from event traces [Coming Soon]

- Akash Gaonkar, **Mike He**, Yi Li, Bo-Yuan Huang, Andrew Cheung, Vishal Canumalla, Gus Smith, Zachary Tatlock, Sharad Malik, and Aarti Gupta. Verification of software-to-hardware mappings for machine learning accelerators [***U.R.***]

- **Mike He**, Haichen Dong, Sharad Malik, and Aarti Gupta. Improving term extraction with acyclic constraints. In *E-Graph Research, Applications, Practices, and Human-factors Symposium* [Paper]

- Bo-Yuan Huang*, Steven Lyubomirsky*, Yi Li, **Mike He**, Thierry Tambe, Gus Smith, Akash Gaonkar, Vishal Canumalla, Gu-Yeon Wei, Aarti Gupta, Sharad Malik, and Zachary Tatlock. Application-level validation of accelerator designs using a formal software/hardware interface. *ACM Trans. Des. Autom. Electron. Syst.* [Paper]

AI (Artificial Intelligence) for/with Formal Methods

- Haoyu Zhao*, Ziran Yang*, Jiawei Li*, **Mike He***, Zenan Li*, Chi Jin, Venugopal Veeravalli, Aarti Gupta, and Sanjeev Arora. Algoveri: An aligned benchmark for verified code generation on classical algorithms. 2026 [***U.R.***]

- Marcus J. Min, **Mike He**, Zhaoyu Li, Zixuan Yi, Sharad Malik, Aarti Gupta, Xujie Si, and Osbert Bastani. Position: The case for theory-level autoformalization. 2026 [***U.R.***]

- Mursalin Kabir Rishat, Uma Anand, **Mike He**, Ankush Desai, and Anand Padmanabha Iyer. Slate: State management with taxonomies for llm agents. 2026 [***U.R.***]

- Center for AI Safety, Scale AI, and HLE Contributors Consortium. A benchmark of expert-level academic questions to assess ai capabilities. *Nature*, 649(8099):1139–1146, 2026 [Paper]

- **Mike He**, Zhendong Ang, Ankush Desai, and Aarti Gupta. Ranking formal specifications using llms. In *International Workshop on Language Models and Programming Languages* (LMPL'25) [Paper]

- Marisa Kirisame*, Steven Lyubomirsky*, Altan Haan*, Jennifer Brennan, **Mike He**, Jared Roesch, Tianqi Chen, and Zachary Tatlock. Dynamic tensor rematerialization. In *International Conference on Learning Representations* (ICLR'21) [Paper]

*: Equal Contribution
U.R.: Under Review

</> Internships

Amazon Web Services, Santa Clara, CA   May. 2025 – Aug. 2025

Applied Scientist Intern   (**C#**/**Python**/**P**/Distributed Systems/Formal Methods)

- Led the development of a specification ranking and distillation algorithm for distributed systems (workshop paper accepted at LMPL'25)
- Implemented Proof Script for *PVerifier* and contributed to its release

Amazon Web Services, Santa Clara, CA   May. 2024 – Aug. 2024

Applied Scientist Intern   (**C#**/**Java**/**P**/Distributed Systems/Formal Methods)

- Developed the *PInfer* framework that **discovers likely invariants for distributed systems** from event traces. Paper accepted at OOPSLA'26.
- Implemented a formal model and specifications of the **Raft** consensus algorithm in **P framework**
- Modeled and proved the correctness of Ring leader election, Paxos, and an AWS internal service in *PVerifier*

Taichi Graphics, Remote and Beijing, China   June. 2022 – Sep. 2022

Compiler R&D Intern   (**C++**/**Python**)

- Refactored the intermediate representation (IR) of Taichi Language
- Implemented standalone **Tensor type** for better compilation speed
- Adapted **compiler passes** (e.g. Load/Store forwarding, Dead code elimination, reaching definition, etc.) to optimize for tensor type expressions
- Implemented **LLVM**-based code generation for tensor type for Superword-level vectorization

Intel Labs, Hillsboro, OR   Mar. 2022 – June. 2022

Formal Verification Research Intern   (Formal Methods/**Python**/**Dafny**)

Developed the **Py***rope* framework for **correct-by-construction** hardware modeling.

- Facilitated **correct-by-construction** hardware modeling purely in Python
- Encoded the correctness proof of (multi-)montgomery reduction algorithm in Python and **verified successfully by compiling to Dafny**
- Unified "sources of truth" for correctness proofs and programming model implementations

☺ Service

- Reviewer: IEEE Transactions on Mobile Computing, AAE@KDD'25, SciPy'25
- Sub-reviewer: OOPSLA'24
- Artifact Evaluation Committee: POPL'25, PLDI'24, POPL'24, MLSys'23, MICRO'21
- Mentor in the Ph.D. application mentoring program (Princeton, 2023)

♀ Teaching

- COS 516: Automated Reasoning about Software (TA, Princeton University, Fall 23 & 24)
- CSE 505: Principles of Programming Languages (TA, University of Washington, Spring 21)

✿ Skills

- **Languages:** C/C++, Python, Rust, OCaml, L∀∃N, Coq, Dafny, etc. (Open to other languages)
- **Compiler & Applied PL:** Equality Saturation, Static Analysis, Computer-aided Reasoning, SMT
- **PL Theory:** Formal Verification, Type Theory, Mathematical Logic
- **Systems:** Distributed Systems, Machine Learning Systems, Data Center Systems
- **Fun Fact:** I am more seasoned in playing the violin than coding ♫; I have:
  1. an Lv.9 certificate* (similar to ABRSM Grade 8) issued by Central Conservative of Music;

2. $>$ **20-year** violin solo experience;
3. Multiple 1st Prizes (various local competitions in Beijing) and a Silver medal (Beijing regional)[†];
4. 6-year experience with symphony orchestras; 3-year experience as *the Principal 2nd Violinist*;
5. 3-year experience with a piano quartet/quintet and multiple string quartets (with 1 CD produced);
6. $\sim$ 4 public concerts with a philharmonic orchestra[⋆] at the [The Giant Egg](), Beijing, China.

[*] : *The highest level for non-professionals*
[†] : *Awarded during middle and high school years.*
[⋆] : *The Beijing National Day School Philharmonic Orchestra*