

# Jianlin "Herman" Li

Ph.D. in programming languages/compilers

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## Objective

I am a **Ph.D.** student in the field of **programming languages**. I care about software safety and efficiency across the entire life cycle: from design (**model checking**), to implementation (**program analysis**, **formal verification** via automatic and **interactive theorem proving**), to compilation (**optimization**, **compiler correctness**). During my Ph.D., I design **probabilistic programming languages (PPLs)** and implement **compilers** for sound and scalable Bayesian inference. My academic work applies **type systems**, **program analyses**, and **logical relations** to achieve efficient, reliable, and certified probabilistic programming.

## Education (Anticipated graduation date: 04/26)

University of Waterloo, Ph.D. in Computer Science	Sep 2021 – Expected April 2026
Supervisors: Yizhou Zhang, Ondřej Lhoták	Cumulative GPA: 98.33/100
Institute of Software, Chinese Academy of Sciences, M.Sc. in Computer Science	Sep 2018 – Aug 2021
Nanjing University of Aeronautics and Astronautics, B.Sc. in Computer Science	Sep 2013 – Jun 2018

## Experience

Research Assistant, University of Waterloo	Sep 2021 – Present
<ul style="list-style-type: none"><li>• <b>GENI (PLDI 2025)</b>: A compiler implemented in <b>Rust</b> that compiles functional programming-style probabilistic programs into generating functions, a compact and exact compilation target representing measures.</li><li>• <b>MAPPL(PLDI 2024)</b>: A compiler implemented in <b>OCaml</b> that enables scalable inference by factorizing recursive probabilistic programs via <b>information-flow typing</b> (with a denotational, <b>logical-relations</b> model).</li><li>• <b>FIDELIO(POPL 2023)</b>: A compiler embodies symbolic methods, e.g., a type system and program analysis, that aid neural-network-based inference (<b>Pyro PPL</b>, <b>PyTorch</b>, <b>LSTM</b>, <b>Deep Amortized Inference</b>, <b>OCaml</b>).</li><li>• Implement maximum entropy reinforcement learning via variational inference in <b>Pyro</b>, a universal probabilistic programming language (PPL) written in Python and supported by <b>PyTorch</b> on the backend.</li></ul>	
Teaching Assistant(taught tutorials, held office hours, etc.), University of Waterloo	Sep 2021 – Present
<ul style="list-style-type: none"><li>• Computer Architecture, Compiler Construction, Logic and Computation, Foundations of Sequential Programs.</li></ul>	
Research Assistant & Exchange Student, Saarland University (Saarbrücken, Germany)	Sep 2019 – Aug 2020
<ul style="list-style-type: none"><li>• Worked on automated safety verification of programs invoking neural networks (published at <b>CAV 2021</b>):<ul style="list-style-type: none"><li>– Trained a heterogeneous controller combining neural networks and handcrafted components (C programs) via reinforcement learning in an <b>OpenAI</b> Minigrid-style environment, enabling autonomous decision-making.</li><li>– Integrated <b>CLAM</b>, a state-of-the-art <b>LLVM</b> bitcode static analyzer, with <b>DEEPSYMBOL</b>(my neural network verifier), enabling a precise neuro-aware verification pipeline (impossible to verify without our approach).</li></ul></li><li>• Generalized Minsky machine halting problem <math>\preceq_m</math> 2 counter machine halting problem in <b>Coq</b>.</li></ul>	
Research Assistant, Institute of Software, Chinese Academy of Sciences	Sep 2018 – Aug 2021
<ul style="list-style-type: none"><li>• Developed <b>DEEPSYMBOL</b>, a verification tool for the robustness of deep neural networks (DNNs).<ul style="list-style-type: none"><li>– Propose a novel <b>symbolic propagation</b> method improving <b>abstract interpretation</b> for DNN analysis.</li><li>– Fixed a severe memory leak in the Zonotope domain of the <b>APRON</b> numerical abstract domain library that prevented scaling, caused by an ABI mismatch leading to memory layout and calling convention errors.</li><li>– Bring benefits of up to <b>549%</b> speedup (9.16h <math>\rightarrow</math> 1.41h) to a state-of-the-art <b>SMT-based verifier</b>.</li></ul></li></ul>	

## Technologies

**Languages/Frameworks:** Rust, OCaml, C++, LLVM, PyTorch, JAX, Coq, Lean, Agda.

**Skills:** Compiler Construction, Formal Methods, Program Verification, Program Analysis.

## Publications

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- [1] **Jianlin Li** and Yizhou Zhang.  
Compiling with Generating Functions.  
*Proc. ACM Program. Lang.*, 9(**ICFP 2025**, Singapore).
- [2] **Jianlin Li**, Eric Wang, and Yizhou Zhang.  
Compiling Probabilistic Programs for Variable Elimination with InformationFlow.  
*Proc. ACM Program. Lang.*, 8(**PLDI 2024**, Copenhagen, Denmark).
- [3] **Jianlin Li**, Leni Ven, Pengyuan Shi, and Yizhou Zhang.  
Type-Preserving, Dependence-Aware Guide Generation for Sound, Effective Amortized Probabilistic Inference.  
*Proc. ACM Program. Lang.*, 7(**POPL 2023**, Boston, United States).
- [4] Maria Christakis, Hasan Ferit Eniser, Holger Hermanns, Jörg Hoffmann, Yugesh Kothari, **Jianlin Li**, Jorge A. Navas, and Valentin Wüstholtz.  
Automated safety verification of programs invoking neural networks.  
*Computer Aided Verification - 33rd International Conference, CAV 2021*.
- [5] Renjue Li, **Jianlin Li**, Cheng-Chao Huang, Pengfei Yang, Xiaowei Huang, Lijun Zhang, Bai Xue, and Holger Hermanns.  
PRODeep: A Platform for Robustness Verification of Deep Neural Networks.  
*ESEC/FSE 2020 : 28th ACM Joint European Software Engineering Conference and Symposium on the Foundations of Software Engineering, USA*.
- [6] Pengfei Yang, Renjue Li, **Jianlin Li**, Cheng-Chao Huang, Jingyi Wang, Jun Sun, Bai Xue, and Lijun Zhang.  
Improving neural network verification through spurious region guided refinement.  
*Tools and Algorithms for the Construction and Analysis of Systems - 27th International Conference, TACAS 2021, as Part of ETAPS 2021, Luxembourg*.
- [7] **Jianlin Li**, Jiangchao Liu, Pengfei Yang, Liqian Chen, Xiaowei Huang, and Lijun Zhang. Analyzing Deep Neural Networks with Symbolic Propagation: Towards Higher Precision and Faster Verification.  
*SAS 2019: 26th Static Analysis Symposium, Porto, Portugal*.
- [8] Hongfei Fu, Yi Li, and **Jianlin Li**.  
Verifying Probabilistic Timed Automata Against Omega-Regular Dense-Time Properties.  
*QEST 2018: 15th International Conference on Quantitative Evaluation of SysTems, China*.

## Awards

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- 2023: David R. Cheriton Graduate Scholarship
- 2021: University of Waterloo Entrance Scholarship
- 2020: China National Scholarship (Top 0.2%)
- 2020/2019: Institute of Software, CAS First-Class Academic Scholarships (Top 10%)
- 2015: Silver Medal, ACM-ICPC Shanghai Metropolitan Programming Contest
- 2014: Silver Medal, ACM-ICPC Asia Regional Contest, Anshan Site
- 2014: China National Scholarship (Top 0.2%)
- 2014: Winning Prize, RoboCup China Open Soccer Simulation 2D

## Services

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- **Sub-Reviewer:** LICS 2018, TASE 2019, FM 2019, FMAC 2019, TACAS 2021, PLDI 2024, OOPSLA 2024.
- **Student Volunteer:** CONCUR 2018, SSFM 2018, SSFM 2019, LICS 2020