

# Jianlin "Herman" Li

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## Objective

I am generally interested in software verification and interactive theorem proving. I design probabilistic programming languages and implement compilers for sound and scalable inference. My 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
Saarland University (exchange)	Sep 2019 – Aug 2020
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

- Design probabilistic programming languages and implement compilers for sound and scalable inference:
  - **GENI (PLDI 2025)**: A compiler implemented in **Rust** that compiles functional programming–style probabilistic programs into generating functions, a compact and exact compilation target representing measures.
  - **MAPPL (PLDI 2024)**: A compiler implemented in **OCaml** that enables scalable inference by factorizing recursive probabilistic programs via **information-flow typing** (with a denotational, **logical-relations** model).
  - **FIDELIO (POPL 2023)**: A compiler embodies symbolic methods, e.g., a type system and program analysis, that aid neural-network–based inference (**Pyro PPL**, **PyTorch**, **LSTM**, **Deep Amortized Inference**, **OCaml**).
- Implement maximum entropy reinforcement learning via variational inference in **Pyro**, a universal probabilistic programming language (PPL) written in Python and supported by **PyTorch** on the backend.

Instructional Apprentice/Teaching Assistant, University of Waterloo Sep 2021 – Present

Computer Architecture, Compiler Construction, Logic and Computation, Foundations of Sequential Programs.

Research Assistant, Saarland University Sep 2019 – Aug 2020

Worked on automated safety verification of programs invoking neural networks (published at **CAV 2021**):

- Trained a heterogeneous controller combining neural and handcrafted components (C programs) via reinforcement learning in an **OpenAI** Minigrid–style environment, enabling autonomous decision-making.
- Integrated **CLAM**, a state-of-the-art **LLVM** bytecode static analyzer, with **DEEPSYMBOL** (my neural network verifier), enabling a precise neuro-aware verification pipeline (impossible to verify without our approach).

Generalized Minsky machine halting problem  $\preceq_m$  2 counter machine halting problem in **Coq**.

Research Assistant, Institute of Software, Chinese Academy of Sciences Sep 2018 – Aug 2021

Developed **DEEPSYMBOL**, a verification tool for the robustness of deep neural networks (DNNs).

- Propose a novel **symbolic propagation** method improving **abstract interpretation** for DNN analysis.
- Fixed a severe memory leak in the Zonotope domain of the **APRON** numerical abstract domain library that prevented scaling, caused by an ABI mismatch leading to memory layout and calling convention errors.
- Bring benefits of up to **549%** speedup (9.16h  $\rightarrow$  1.41h) to a state-of-the-art **SMT**-based **verifier**.

## Technologies

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

**Skills:** Compiler Construction, Semantics, Type Systems, Verification, Formal Methods, 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