Jianlin "Herman" Li

jianlin.li@uwaterloo.ca | jianlin-herman-li.github.io

Google Scholar: BBoZG7gAAAAJ | linkedin.com/in/jianlin-herman-li

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 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

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 networks 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** bitcode 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 $\preccurlyeq_m$ 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

[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 Wüstholz.
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

- 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

- **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