Yunqi He

http://actasclown.github.io

Email : yunqi.he@u.northwestern.edu

Mobile : +1-773-290-0801

Education

Northwestern University   **Evanston, IL**
Ph.D. in Computer Engineering, advised by **Prof. Hai Zhou**   *Jan. 2022 – Jun. 2026(estimated)*

Northwestern University   **Evanston, IL**
M.S. in Computer Engineering   *Sept. 2019 – Dec. 2021*

Peking University   **Beijing, China**
B.S. in Computer Science   *Sept. 2013 – Jun. 2017*

Selected Projects   (*M- Machine Learning | H- Hardware Design | F- Formal Verification*)

[MF] **Robustness Verification for Deep Neural Networks [1] [2]** | *Pytorch, Linear Programming*   *Feb. 2023 - Present*
- Proposed a systematic I/O attack combining algebraic and learning-based approaches on DNNs protected by a logic locking scheme.
- Utilized probabilistic methods, abstract interpretation, and abstraction refinement to find adversarial examples or to certify the robustness of DNNs.
- Contribution: Designed the learning-based attack.
- Ongoing work: Narrowing down to formal-certified reinforcement learning. Trying to approximate the model in reinforcement learning to provide formal property proofs.

[M] **Explainable Deep Skin Disease Diagnosis [3] [4]** | *Pytorch, Pyro, Probabilistic Programming*   *May. 2021 - Present*
- Proposed an architecture that combines deep neural networks as nodes into Bayesian networks, which combines human experts' knowledge with the perceptual results of deep learning tools.
- Developed a tool for automated dermatology diagnosis using skin lesion images and clinical information.
- Contribution: Came up with the idea, realized the design, and conducted experiments on different datasets.
- Ongoing work: Proposing a new building approach to current architecture to enhance scalability.

[F] **Principles of Symbolic Model Checking [5]** | *Verilog , Python, C++, SAT/SMT*   *Mar. 2022 - Nov. 2022*
- Proposed an efficient algorithm to check whether two systems are equivalent modulo arbitrary timing differences. The algorithm returns either an inductive invariant that represents the refinement mapping of the two systems as the proof of correctness, or a counterexample as the proof of violation.
- Developed a tool to check the correctness of design transformations such as high-level synthesis and RTL optimization.
- Contribution: Designed and conducted experiments to compare our tool with existing commercial tools, including Cadence Jasper SEC, Mentor Catapult SLEC, and Synopsys Hector.

[HF] **Hardware IP Protection via Logic Encryption [6]** | *Verilog , Python, C++, SAT/SMT*   *May. 2021 - Feb. 2022*
- Employed logic synthesis and obfuscation to achieve indistinguishable encryption and to minimize the overheads.
- Utilized a behavioral model to launch oracle-guided I/O attacks on logic encryption.
- Contribution: Verified the obfuscation in aig level. Evaluated the overhead of our approach using Innovus and Genus.

[H] **GRT Sensing v1.0** | *Verilog, C*   *June, 2017 - Jan, 2018*
- Reviewed the code of GRT 2.0(an FPGA-based SDR Platform).
- Derived additional status output from the $rx\_channel\_estimation$ module of the physical layer and export CSI.
- Wrote a serial port receiving program for the exported output to visually display the changes in CSI near the antenna in real time, laying the foundation for wireless perception.

[MH] **FPGA-based CNN Accelerator** | *TCL, C*   *April, 2016*
- Used TCL scripts to modify specific calculation processes via the Xilinx Vivado toolchain.

Technical Skills

Programming Languages: Java, Verilog/VHDL, C/C++, Python(Pytorch/Pyro), CUDA, MySQL, Matlab, Rust
Teaching Assistant: Fundamentals of Blockchains and Decentralization (Fall 2021), Fundamentals of Computer System Software (Winter 2023), Advanced Digital Design (Spring 2023), Introduction to Computer Engineering (Winter 2024)

Awards

- Northwestern Univerisity Ph.D. Fellowship (2022)
- "Excellent Graduation Design"(top 5%) of EECS Department, Peking University (2017)
- 3rd Prize, ACM Programming Contest of Peking University (2015)

Work Experience

Beijing Yidian Science and Technology Co., Ltd | *Project Manager* *Oct. 2017 - June. 2019*
- Participated in the preparation of a start-up company.
- Participated in the design of a multi-sided platform to connect online diagnosis and treatment and offline resources
- Completed the major part of the platform with functions of online inquiry, hospital searching, online registration, and after-treatment services

Publications

[1] You Li*, Guannan Zhao*, **Yunqi He**, and Hai Zhou. Evaluating the security of logic locking on deep neural networks. In *DAC 2024*.

[2] You Li*, Guannan Zhao*, **Yunqi He**, and Hai Zhou. Certifying global robustness for deep neural networks. In Submission.

[3] **Yunqi He**, Linglong Cai, Taimei Cui, You Li, and Hai Zhou. A combination of dnn and bn for automatic skin disease diagnosis. In *2023 IEEE 20th International Symposium on Biomedical Imaging (ISBI)*, pages 1–5. IEEE, 2023.

[4] **Yunqi He**, Jiahe Liu, Linglong Cai, Taimei Cui, You Li, and Hai Zhou. A multimodal automated dermatology diagnostic architecture with scalability and agility. In Submission.

[5] You Li*, Guannan Zhao*, **Yunqi He**, and Hai Zhou. Se3: Sequential equivalence checking for non-cycle-accurate design transformations. In *DAC 2023*.

[6] You Li*, Guannan Zhao*, **Yunqi He**, and Hai Zhou. Obfuslock: An efficient obfuscated locking framework for circuit ip protection. In *DATE 2023*.