Jingyao Zhang

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Interest: Enhancing the **performance** of **privacy-preserving systems** across both **software** and **hardware** domains.

Education

University of California, Riverside — Riverside, USA
Ph.D. Candidate in Computer Science, GPA: 3.7/4.0 — *Sep 2021 – Present*
Advisor: Elaheh Sadredini

Xidian University — Xi'an, China
M.E. in Electronic and Telecommunications Engineering, GPA: 3.7/4.0; Outstanding Thesis Award — *Sep 2018 – Jun 2021*
B.E. in Telecommunications Engineering, GPA: 3.7/4.0; Pilot Class (Top 5% of 800+) — *Sep 2014 – Jun 2018*

Work Experience

Operating System Lab, DAMO Academy — *Mentor: Yue Qian*
External Developer — *Aug 2023 – Present*

- Currently building a system for large-scale cloud deployment that provides GPU confidential computing.
- Designed and developed a *Combined Attestation* framework for *CoCo KBS* to support GPU attestation. [demo]
- Conducted research on the *nvTrust* for Nvidia confidential computing, including verification and attestation.
- Investigated existing systems that support GPU confidential computing, such as *Azure Confidential AI*.

Open Source Promotion Plan, Chinese Academy of Sciences — *Mentor: Ding Ma*
Project Developer — *Jul 2023 – Sep 2023*

- Developed a workflow that automatically generates reference measurements for user image, firmware, and kernel on the AMD SEV-SNP platform, compatible with *Confidential Containers*. [repo]
- Examined the attestation process on the AMD SEV-SNP platform, including the generation of reference measurement.
- Evaluated attestation tools across various cloud service providers, such as Google Cloud Platform and Azure.

Publications

1. **Jingyao Zhang**, and Elaheh Sadredini. "A Near-Cache Architectural Framework for Cryptographic Computing." *In Submission.*
2. **Jingyao Zhang**, and Elaheh Sadredini. "Unlocking Energy-Efficient and High-Throughput Secure Data Communication in IoT with Memory-Centric Computing." *In Submission.*
3. **Jingyao Zhang**, Mohsen Imani, and Elaheh Sadredini. "BP-NTT: Fast and Compact in-SRAM Number Theoretic Transform with Bit-Parallel Modular Multiplication." *In Proc. of the 60th Design Automation Conference (DAC). July 2023.*
4. **Jingyao Zhang**, and Elaheh Sadredini. "Inhale: Enabling High-Performance and Energy-Efficient In-SRAM Cryptographic Hash for IoT." *In Proc. of the 41th International Conference on Computer-Aided Design (ICCAD). November 2022.*
5. **Jingyao Zhang**, Hoda Naghibijouybari, and Elaheh Sadredini. "Sealer: In-SRAM AES for High-Performance and Low-Overhead Memory Encryption." *In Proc. of the 22th International Symposium on Low Power Electronics and Design (ISLPED). August 2022.*
6. **Jingyao Zhang**, Huaxi Gu, Li Zhang, Bing Li, and Ulf Schlichtmann. "Hardware-Software Codesign of Weight Reshaping and Systolic Array Multiplexing for Efficient CNNs." *In Proc. of the 24th Design, Automation and Test in Europe (DATE). February 2021.*

Research Experience

AREA Lab, University of California, Riverside — *Advisor: Elaheh Sadredini*
Graduate Research Assistant — *Sep 2021 – Present*

- Currently developing a general-purpose compiler for domain-specific accelerators using MLIR and E-Graph-based searching, specifically targeting workloads that involve vector and scalar kernels as well as mixed-precision workloads.
- Currently designing an on-chip solution for accelerating quantized language models, including dynamic data precision adaptation and efficient runtime de-/quantization.
- Developed a framework to seamlessly integrate in-SRAM computing into existing computer systems for efficient and secure on-chip processing of pre- and post-quantum cryptography.
- Developed a bit-parallel modular multiplication algorithm with implicit shifting technology for efficient and secure in-SRAM computing of the NTT, optimizing performance on a low-overhead SRAM array.

- Designed a secure in-SRAM architecture for on-chip acceleration of the AES/SHA-3 algorithm using row/lane-wise data alignment, achieving high energy and area efficiency with high throughput.

Advanced Networking Technology Lab, Xidian University *Advisor: Huaxi Gu*

Graduate Research Student *Sep 2018 – Jun 2021*

- Developed a hardware-software co-design framework for efficient CNNs, leveraging weight reshaping and systolic array multiplexing with genetic algorithms for optimal hardware performance.
- Built a distributed inference system for accelerating CNNs using systolic array on FPGAs, with HLS for low-level hardware description and Aurora/Ethernet protocols for inter-board communication.
- Designed a flexible and compact N $\times$ N plasmonic switch topology with a dedicated configuration algorithm that ensures re-arrangeable non-blocking, making it ideal for managing mixed traffic in data centers.
- Designed a low-loss compact plasmonic router for mesh networks in optical Network-on-Chip, exhibiting lower insertion loss and a smaller footprint compared to other structures.

Teaching Experience

CS 161 Design and Architecture of Computer Systems *Instructor: Elaheh Sadredini*

Teaching Assistant *Sep 2023 – Dec 2023*

- Hosted three discussion sessions per week to supplement lecture, homework and lab.
- Held weekly office hours to answer students' questions.

CS 213 Multiprocessor Architecture and Programming *Instructor: Elaheh Sadredini*

Teaching Assistant *Sep 2022 – Dec 2022*

- Led two discussion sessions of students' presentations.
- Held weekly office hours to answer students' questions.
- Graded homework and programming assignments.

Other Experience

gem5 Boot Camp Davis, USA

Participant *Jul 2022 – Jul 2022*

- Simulated and analyzed the performance of computer architectures, and studied the behavior of different workloads and benchmark suites on various computer architectures.
- Evaluated the impact of different design choices on system performance, such as varying cache sizes or using different interconnect topologies, and explored the effects of different microarchitectural features.

Xilinx Summer Camp Online

Participant & Team Leader *Jul 2020 – Aug 2020*

- Developed an FPGA-based distributed platform for acceleration over Ethernet, with the mother board sending a file to a watched folder on the child board for immediate program execution. [repo]

Microsoft Innovation Center Xi'an, China

Intern *Jul 2017 – Aug 2017*

- Explored the advancements and challenges in the evolution of cellular networks across generations, starting from the early analog systems to the 5G technology.

Talks

1. **Jingyao Zhang**. "Combined Attestation." *In Confidential Containers Community Meeting.* [slides] [video] [demo] *Nov 2023*
2. **Jingyao Zhang**. "Safeguard Your Cloud Workloads: An In-depth Look at Confidential Computing." *In Proc. of IEEE Inland Empire Data Science Workshop (IEDSW).* [link] *Nov 2023*
3. **Jingyao Zhang**. "Safeguard Your Cloud Workloads and Then Accelerate: An In-depth Look at CPU and GPU Confidential Computing." *Remotely at ByteDance in Mandarin.* ***Live Attendance:*** $\sim$***300***. [slides] [video] *Oct 2023*
4. **Jingyao Zhang**. "BP-NTT: Fast and Compact in-SRAM Number Theoretic Transform with Bit-Parallel Modular Multiplication." *In Proc. of the 60th Design Automation Conference (DAC). San Francisco, CA.* [slides] [video] *Jul 2023*
5. **Jingyao Zhang**. "Inhale: Enabling High-Performance and Energy-Efficient In-SRAM Cryptographic Hash for IoT." *In Proc. of the 41th International Conference on Computer-Aided Design (ICCAD). San Diego, CA.* [slides] [video] *Nov 2022*
6. **Jingyao Zhang**. "Sealer: In-SRAM AES for High-Performance and Low-Overhead Memory Encryption." *In Proc. of the 22th International Symposium on Low Power Electronics and Design (ISLPED). Online.* [slides] [video] *Aug 2022*
7. **Jingyao Zhang**. "Hardware-Software Codesign of Weight Reshaping and Systolic Array Multiplexing for Efficient CNNs." *In Proc. of the 24th Design, Automation and Test in Europe (DATE). Online.* [slides] [video] *Feb 2021*

Awards

DAC Young Fellowship, Design Automation Conference *2023*
Dean's Distinguished Fellowship Award, University of California, Riverside *2021*
Outstanding Thesis Award, Xidian University *2021*
First-class Scholarship, Xidian University (Top 14% of 560+) *2018, 2019*
Outstanding Student Award, Xidian University *2018, 2019*

Grants

Conference Travel Grant, University of California, Riverside *2023*
Student Travel Grant, gem5 Boot Camp *2022*

Services

Reviewed Papers: 7

Journal Paper Review, IEEE Computer Architecture Letters (CAL) - (6) *2023*
Conference Paper Review, IEEE International Conference on Communication (ICC) - (1) *2024*

Evaluated Artifacts: 13

Artifact Evaluation Board, Journal of Systems Research (JSys) - (1) *2023*
Artifact Evaluation Committee, USENIX Security Symposium - (1) *2024*
Artifact Evaluation Committee, ACM Conference on Computer and Communications Security (CCS) - (1) *2024*
Artifact Evaluation Committee, ACM European Conference on Computer Systems (EuroSys) - (3) *2024*
Artifact Evaluation Committee, Annual Network and Distributed System Security Symposium (NDSS) - (2) *2024*
Artifact Evaluation Committee, ACM Symposium on Operating Systems Principles (SOSP) - (2) *2023*
Artifact Evaluation Committee, ACM International Conference On Mobile Computing And Networking (MobiCom) - (1) *2023*
Artifact Evaluation Committee, USENIX Annual Technical Conference (ATC) - (1) *2023*
Artifact Evaluation Committee, USENIX Symposium on Operating Systems Design and Implementation (OSDI) - (1) *2023*

Skills

Programming: C, C++, Python, Verilog, Rust, MLIR
Technologies: Gem5, Sniper, HSpice, PyTorch, LLVM
Languages: Chinese (Native), English (Professional)