

Haiyu Mao

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EDUCATIONAL BACKGROUND

ETH Zurich Postdoc researcher in Computer Science; Advisor: Prof. Onur Mutlu	Zurich, Switzerland 07.2020 – Present
Tsinghua University Ph.D. in Computer Science and Technology; Advisor: Prof. Jiwu Shu; GPA: 3.7/4.0 (Rank:24/95)	Beijing, China 08.2015 – 07.2020
Northeastern University Bachelor in Software Engineering; GPA: 90/100 (Rank: 1/201)	Shenyang, China 08. 2011 – 07.2015

SELECTED PRACTICAL EXPERIENCE

Acceleration of Genome Analysis on Raw Signal Data + Designing a CAM-based accelerator along with the algorithm for analyzing a large amount of raw digit-signal data. + Analyzed the bottleneck of GPU when it is executing genome analysis on raw-signal data.	ETH Zurich, Postdoc, 11.2021 - Present
In-Memory Genome Analysis + Pioneered an in-memory acceleration of genome analysis through a tight integration of basecalling and read mapping. + Designed a tight pipeline to minimize data movement by eliminating the need for storing intermediate results. + Proposed an early-rejection mechanism to stop inefficient computation based on the timely feedback from quality control and read mapping stages.	ETH Zurich, Postdoc, 09.2020 - 11.2021
Durable NVM-based PIM for Training Neural Networks + Studied the write behavior of updating the weight matrix in the NVM-based PIM array during neural network training. + Proposed a scheme for long-lived PIM by (a) leveraging the characteristics of NVM cells and (b) combining the inherent fault-tolerance characteristic of the neural networks and their particular weight updating behaviors.	Tsinghua University, PhD, 10.2018 - 07.2020
Analysis of The Data Collected by FAST + Pre-processed and analyzed the astronomical data collected by the Five-hundred-meter Aperture Spherical Telescope (FAST) located in a natural basin in Pingtang County, Guizhou, China. + Realized a web crawler to collect the published astronomical data and compared with the data collected by FAST.	National Astronomical Observatories, Intern, 06.2019 - 08.2019
Efficient NVM-based PIM for Machine Learning Applications + Put forward a data reshaping mechanism that removes zero-related computations, along with a structured data mapping mechanism to save both storage capacity and communication bandwidth in PIM. + Designed a 3D reconfigurable interconnect fabric in PIM to radically shorten the routing paths.	Tsinghua University, PhD, 04.2017 - 10.2018
Secure and Efficient Non-Volatile Memories + Devised a scheme that reveals the information of the address mapping through read latency difference between row-offer hit and miss, whereby an effective wear-out attack on the physical data location can be conducted. + Proposed a countermeasure that prolongs the lifetime of NVM compared with the state-of-the-art wear-leveling scheme, while only introducing trivial hardware overhead.	Tsinghua University, PhD, 12.2015 - 04.2017
Secure and Efficient Non-Volatile Memories + Realized a scratchpad-memory-based data placement scheme to reduce the movement of read/write ports in Racetrack Memory by leveraging the genetic algorithm.	Peking University, Intern, 01.2015 - 12.2015

PUBLICATIONS

1. **Mao H**, Alser M, Sadrosadati M, Firtina C, Baranwal A, Cali DC, Manglik A, Alserr NA, and Mutlu O, "GenPIP: In-Memory Acceleration of Genome Analysis by Tight Integration of Basecalling and Read Mapping", in submission to *International Symposium on Microarchitecture*, (**MICRO**), October 2022.
2. Manglik A, **Mao H**, Salami B, Park J, Orosa L, Patel M, Singh G, and Mutlu O, "NEAR: Enabling Flexible Resistive Memory Substrates for End-to-End Deep Neural Network Inference", in submission to *International Symposium on Microarchitecture*, (**MICRO**), October 2022.
3. Yang F, Lu Y, **Mao H**, Gao C, and Shu J, "PireSPM: Efficient and Recoverable Secure Persistent Memory for Multi-cores", in submission to *International Symposium on Microarchitecture*, (**MICRO**), October 2022.
4. Alser M, Lindegger J, Firtina C, Almadhoun N, **Mao H**, Singh G, Gomez-Luna J, and Mutlu O, "From Molecules to Genomic Variations: Accelerating Genome Analysis via Intelligent Algorithms and Architectures", in submission to *Computational and Structural Biotechnology Journal*, (**CSBJ**), April 2022.
5. Ghiasi NM, Park J, Mustafa H, Kim J, Gollwitzer A, Olgun A, **Mao H**, Firtina C, Cali DS, Alserr NA, Ausavarungnirun R, Vijaykumar N, Alser M, and Mutlu O, "GenStore: An In-Storage Processing System for Genome Sequence Analysis", in *ACM International Conference on Architectural Support for Programming Languages and Operating Systems* (**ASPLOS**), March 2022.
6. **Mao H**, Shu J, Song M, and Li T, "LrGAN: A Compact PIM-based GAN Architecture with Low Energy Consumption", in *IEEE Transactions on Computers* (**TC**), 2021.
7. **Mao H**, Shu J, Li F, and Liu Z, "The Development of Processing In Memory", in *SCIENTIA SINICA Informationis*, (**SSI**), (In Chinese), 2020.
8. Yang F, Chen Y, **Mao H**, Lu Y, and Shu J, "Libra: An Efficient and Fast Recoverable System for Secure Non-Volatile Memory", in *ACM Transactions on Storage* (**TOS**), 2020.
9. **Mao H**, and Shu J, "3D Memristor Array Based Neural Network Processing in Memory Architecture", in *Journal of Computer Research and Development*, (In Chinese), 2019.
10. Yang F, Lu Y, Chen Y, **Mao H**, and Shu J, "No Compromises: Secure NVM with Crash Consistency, Write-Efficiency and High-Performance", in *Design Automation Conference* (**DAC**), June 2019.
11. **Mao H**, Song M, Li T, Dai Y, and Shu J, "LerGAN: A Zero-Free, Low Data Movement and PIM-Based GAN Architecture", in *International Symposium on Microarchitecture* (**MICRO**), October 2018.
12. **Mao H**, Zhang X, Sun G, and Shu J, "Protect Non-Volatile Memory from Wear-Out Attack Based on Timing Difference of Row Buffer Hit/Miss", in *Conference on Design, Automation & Test in Europe* (**DATE**), March 2017.
13. **Mao H**, Zhang C, Sun G, and Shu J, "Exploring Data Placement in Racetrack Memory Based Scratchpad Memory", in *Non-Volatile Memory System and Applications Symposium* (**NVMSA**), August 2015.

SELECTED AWARDS

Outstanding Ph.D. Graduate in Beijing (Top 5 in the department)	Beijing, 2020
National Scholarship for Ph.D. (2.5%)	Ministry of National Education of China, 2019
Outstanding Undergraduate in Shenyang (0.26%)	Shenyang, 2014
Outstanding Pioneer Student (0.5%, three times)	Northeastern University, 2012/2013/2014
National Scholarship (1%, three times)	Ministry of National Education of China, 2012/2013/2014

LANGUAGE SKILLS

Chinese: Native speaker; **English:** Professional working proficiency; **Japanese:** Beginner.

TECHNICAL SKILLS

- **Programming Languages:**
Expert: Python, C; **Proficient:** C++, Java; **Prior experience:** Javascript, Go, MPI, OpenMP, CUDA, Matlab
- **Frameworks:** Caffe, TensorFlow, PyTorch, Hadoop, Spark
- **Simulators:** Gem5, DRAMSim, NVSim, NVmain, CACTI

SELECTED SERVICES AND TEACHING ASSISTANCE

ETH Future Computing Laboratory	Group Associate, 2021/2022
+ Proposed "PIM-based Acceleration of Genome Analysis" to EFCL Funding Committee as a principal investigator.	
+ Organized seminars (e.g. invited Fabrice Devaux, the CTO of UPMEM, to introduce UPMEM DPU Architecture).	
Computer Architecture Courses	Teaching Assistant, 2020/2021
+ Developed homework/exams; Prepared and managed teaching materials; Answered questions from students.	
SAFARI Project & Seminars courses	Mentor, 2021/2022
+ Proposed and supervised practical PIM projects; Helped students to code the simulation of PIM architectures.	
Journal Reviews (ACM Computing Surveys, IEEE Micro, IEEE Transactions on Computers)	Reviewer, 2021/2022