Haiyu Mao

Homepage: https://hybol1993.github.io/
LinkedIn: linkedin.com/in/haiyu-mao-328a10104
Date of birth: 13.03.1993
Gender: Female
Nationality: China
Email: maohaiyu1993@gmail.com
Phone: +41 76-830-6068
Address: Stettbachstrasse 43, 8051, Zurich, Switzerland

EDUCATIONAL BACKGROUND

ETH Zurich   Zurich, Switzerland
Postdoc researcher in Computer Science;   07.2020 – Present
Advisor: Prof. Onur Mutlu

Tsinghua University   Beijing, China
Ph.D. in Computer Science and Technology;   08.2015 – 07.2020
Advisor: Prof. Jiwu Shu; GPA: 3.7/4.0 (Rank:24/95)

Northeastern University   Shenyang, China
Bachelor in Software Engineering;   08. 2011 – 07.2015
GPA: 90/100 (**Rank: 1/201**)

SELECTED PRACTICAL EXPERIENCE

Memory System Design for AI/ML Accelerators   ETH Zurich, Research Scholar, 01.2020 - Present
+ Contributing to the Semiconductor Research Corporation (SRC) program led by Prof. Onur Mutlu by conducting research on non-volatile memory (NVM) system design for machine learning accelerators.
+ Designed a durable and energy-efficient NVM system for in-memory neural network training by utilizing low-quality NVM cells to store insignificant weight values of neural networks.

Acceleration of Genome Analysis on Raw Signal Data   ETH Zurich, Postdoc, 11.2021 - Present
+ 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.

In-Memory Genome Analysis   ETH Zurich, Postdoc, 09.2020 - 11.2021
+ 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.

Durable NVM-based PIM for Training Neural Networks   Tsinghua University, PhD, 10.2018 - 07.2020
+ 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.

Analysis of The Data Collected by FAST   National Astronomical Observatories, Intern, 06.2019 - 08.2019
+ 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.

Efficient NVM-based PIM for Machine Learning Applications   Tsinghua University, PhD, 04.2017 - 10.2018
+ 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.

Secure and Efficient Non-Volatile Memories   Tsinghua University, PhD, 12.2015 - 04.2017
+ 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.

Secure and Efficient Non-Volatile Memories   Peking University, Intern, 01.2015 - 12.2015
+ Realized a scratchpad-memory-based data placement scheme to reduce the movement of read/write ports in Racetrack Memory by leveraging the genetic algorithm.

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 *International Symposium on Microarchitecture*, (**MICRO**), October 2022.
2. 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 *Computational and Structural Biotechnology Journal*, (**CSBJ**), August 2022.
3. 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.
4. **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.
5. **Mao H**, Shu J, Li F, and Liu Z, "The Development of Processing In Memory", in *SCIENTIA SINICA Informationis*, (**SSI**), (In Chinese), 2020.
6. 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.
7. **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.
8. 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.
9. **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.
10. **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.
11. **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.

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.
Reviews (DATE, ACM Computing Surveys, IEEE Micro, IEEE Transactions on Computers)   Reviewer, 2021/2022