Hyokeun Lee

Ph.D.

Assistant Professor
Department of Electrical and Computer Engineering
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RESEARCH INTERESTS

- Disaggregated systems, memory security, memory reliability, non-volatile memory, computer architecture

EDUCATION

•Seoul National University, Seoul, South Korea   *Sep. 2016-Aug. 2021*
Ph.D. Electrical and Computer Engineering

– Advisor: Dr. Hyuk-Jae Lee; Co-advisor: Dr. Hyun Kim
– Dissertation: Mitigating Disturbance Errors and Enhancing RMW Performance for PCM

•Seoul National University, Seoul, South Korea   *Sep. 2011 - Aug. 2016*
B.S. Electrical and Computer Engineering

WORK EXPERIENCE

•Department of Electrical and Computer Engineering, Ajou University   *Mar. 2024 - Present*
Assistant Professor   Gyeonggi, South Korea

•Secure and Advanced Computer Architecture Group, North Carolina State University *Feb. 2023 - Jan. 2024*
Postdoctoral researcher   Raleigh
– Mentor: Dr. Amro Awad

•Inter-university Research Center, Seoul National University   *Sep. 2021 - Feb. 2023*
Postdoctoral researcher   Seoul, South Korea
– Mentor: Dr. Hyuk-Jae Lee
– I also served the mandatory military service as a Technical Research Personnel.

PUBLICATIONS

#: co-first author; *: corresponding author(s)

•Conference

– Jihoon Jang, Hyokeun Lee*, Hyun Kim*, "*EDeN: Enabling Low-Power CNN Inference on Edge Devices Using Prefetcher-Assisted NVM Systems,*" ACM/IEEE International Symposium on Lower Power Electronics and Design (ISLPED), Aug. 2024.
– Debpratim Adak, Hyokeun Lee, Ben Feinberg, Gwendolyn Voskuilen, Clayton Hughes, Huiyang Zhou, Amro Awad, "*SEFsim: A Statistically-Guided Fast DRAM Simulator,*" IEEE International Symposium on Performance Analysis of Systems and Software (ISPASS), May. 2024 (Poster).
– Rahaf Abdullah, Hyokeun Lee, Huiyang Zhou, Amro Awad, "*Salus: Efficient Security Support for CXL-Expanded GPU Memory,*" International Symposium on High-Performance Computer Architecture (HPCA), Mar. 2024.
– Faiz Alam#, Hyokeun Lee#, Abhishek Bhattacharjee, Amro Awad, "*CryptoMMU: Enabling Scalable and Secure Access Control of Third-Party Accelerators,*" IEEE/ACM International Symposium on Microarchitecture (MICRO), Oct-Nov. 2023 (**Best Paper Candidate**).
– Hyokeun Lee, Kwanseok Choi, Hyuk-Jae Lee, Jaewoong Sim, "*SDM: Sharing-enabled Disaggregated Memory System with Cache Coherent Compute Express Link,*" International Conference on Parallel Architectures and Compilation Techniques (PACT), Oct. 2023.
– Shubham Nema, Shiva Kaushik Chunduru, Charan Kodigal, Gwendolyn Voskuilen, Scott Hmmert, Hyokeun Lee, Amro Awad, Clayton Hughes, "*ERAS: A Flexible and Scalable Framework for Seamless Integration of RTL models with Structural Simulation Toolkit,*" IEEE International Symposium on Workload Characterization (IISWC), Oct. 2023 (Poster).
– Hyokeun Lee, Hyungsuk Kim, Seokbo Shim, Seungyong Lee, Dosun Hong, Hyuk-Jae Lee, Hyun Kim, "*PCMCsim: An Accurate Phase-Change Memory Controller Simulator and its Performance Analysis,*" IEEE International Symposium on Performance Analysis of Systems and Software (ISPASS), May. 2022.

- Hyeong Gi Seong, Hyokeun Lee, Hyun Kim, Hyuk-Jae Lee, "*Analysis of Hardware Prefetchers Suitable for CNN Applications,*" IEEE/IEIE International Conference on Consumer Electronics-Asia (ICCE-Asia), Nov. 2021.
- Hyokeun Lee, Seungyong Lee, Moonsoo Kim, Hyun Kim, Hyuk-Jae Lee, "*IMDB: A Low-Cost In-Module Disturbance Barrier for Mitigating Write Disturbance Errors in Phase-Change Memory,*" Design Automation Conference (DAC, *work-in-progress session*), July. 2020.
- Hyokeun Lee, Donghyeon Lee, Hyuk-Jae Lee, "*A Predictive Initialization of Hidden State Parameters in a Hidden Markov Model for Hand Gesture Recognition,*" IEEE/IEIE International Conference on Consumer Electronics-Asia (ICCE-Asia), June. 2018.

•Journal

- Minseok Seo, Jungi Hyun, Seongho Jeong, Xuan Truong Nguyen, Hyuk-Jae Lee, Hyokeun Lee*, "*OASIS: Outlier-Aware KV Cache Clustering for Scaling LLM Inference in CXL Memory Systems,*" IEEE Computer Architecture Letters, 2025 *(Accepted)*
- Hyokeun Lee, Seungyong Lee, Byeongki Song, Moonsoo Kim, Seokbo Shim, Hyuk-Jae Lee, Hyun Kim, "*An In-Module Disturbance Barrier for Mitigating Write Disturbance in Phase-Change Memory,*" IEEE Transactions on Computers, April. 2023.
- Hyokeun Lee, Hyuk-Jae Lee, Hyun Kim, "*A Read Disturbance Tolerant Phase Change Memory System for CNN Inference Workloads,*" Journal of Semiconductor Technology and Science, Aug. 2022.
- Moonsoo Kim, Hyokeun Lee, Hyun Kim, Hyuk-Jae Lee, "*WL-WD: Wear-Leveling Solution to Mitigate Write Disturbance Errors for Phase-Change Memory,*" IEEE Access, Feb. 2022.
- Seungyong Lee, Hyokeun Lee, Hyuk-Jae Lee, Hyun Kim, "*Evaluation of Various Workloads in Filebench Suitable for Phase-change Memory,*" IEIE Transactions on Smart Processing & Computing, April. 2021.
- Hyokeun Lee, Hyunmin Jung, Hyuk-Jae Lee, Hyun Kim, "*Bit-width Reduction in Write Counters for Wear Leveling in a Phase-change Memory System,*" IEIE Transactions on Smart Processing & Computing, Oct. 2020.
- Jinwoo Park, Hyokeun Lee, Boyeal Kim, Dong-Goo Kang, Seung Oh Jin, Hyun Kim, Hyuk-Jae Lee, "*A Low-Cost and High-Throughput FPGA Implementation of the Retinex Algorithm for Real-Time Video Enhancement,*" IEEE Transactions on Very Large Scale Integration Systems, Jan. 2020.
- Hyokeun Lee, Moonsoo Kim, Hyunchul Kim, Hyun Kim, Hyuk-Jae Lee, "*Integration and Boost of a Read-Modify-Write Module in Phase Change Memory System,*" IEEE Transactions on Computers, Dec. 2019.
- Sunwoong Kim, Hyunmin Jung, Woojae Shin, Hyokeun Lee, Hyuk-Jae Lee, "*HAD-TWL: Hot Address Detection-based Wear Leveling for Phase-Change Memory Systems with Low Latency,*" IEEE Computer Architecture Letters, July. 2019.

•Patents

- "*Mitigating Write Disturbance Errors of Phase-Change Memory Module,*" US Patent, No. 11462266, Oct. 2022. (Granted)
- "*Semiconductor Memory Device Performing Command Merging and Operating Method Thereof,*" US Patent, No. 11055025, July. 2021. (Granted)
- "*Semiconductor Device for Managing Cold Addresses of Nonvolatile Memory Device,*" US Patent, No. 10877698, Dec. 2020. (Granted)
- "*Semiconductor Device for Managing Wear Leveling Operation of a Nonvolatile Memory Device,*" US Patent, No. 10713159, July. 2020. (Granted)

•Submitted (current research status)

- Younghoon Ko, Hyemin Park, Hyuk-Jae Lee, Hyokeun Lee*, IEEE/ACM International Symposium on Microarchitecture (MICRO), 2025, *under review as double-blind*
- Minseok Seo, Seongho Jeong, Hyuk-Jae Lee, Hyokeun Lee*, IEEE International Symposium on High-Performance Computer Architecture (HPCA), 2026, *to-be-submitted as double-blind*
- John McFarland, Hyokeun Lee, Aydin Aysu, Amro Awad, IACR Transactions on Cryptographic Hardware and Embedded Systems (TCHES), 2025, *under review as double-blind*

PROJECT FUNDING GRANTS

•Development of Secure, High-Performance, and High-Connectivity Chiplet-SoC Architecture

Sponsor: MOTIE, South Korea   April. 2025 - Dec. 2027
- Role: *PI as lead organization*; Funded (own/total): ₩250M / ₩500M +α from private company
- Development of secure chiplet architecture
- Reformulation of LLM data structures and development of supporting architectures for chiplet

•Development of Flash Memory-based AI Processing Unit for On-Device AI

Sponsor: IITP, South Korea   April. 2025 - Dec. 2029
- Role: *PI as joint research organization*; Funded (own/total): ₩380M / ₩7,220M
- Development of data filtering architecture for efficient LLM near-storage processing

Professional Activities

•2025
- Artifact Eval. Chair, IEEE International Symposium on Performance Analysis of Systems and Software (ISPASS)
- Reviewer, IEEE Computer Architecture Letters
- Reviewer, IEEE Transactions on Dependable and Secure Computing
- Program Committee, IEEE International Parallel & Distributed Processing Symposium (IPDPS)

•2024
- Reviewer, IEEE Transactions on Computers
- Reviewer, ACM Transactions on Architecture and Code Optimization
- Reviewer, Springer The Journal of Supercomputing
- Program Committee, The 42nd IEEE International Conference on Computer Design (ICCD)
- Program Committee, Great Lakes Symposium on VLSI (GLSVLSI)
- Reviewer, International Conference on Electronics, Information, and Communication (ICEIC)

•2023
- Program Committee, The 41st IEEE International Conference on Computer Design (ICCD)
- Reviewer, IEEE Conference on Artificial Intelligence Circuits and Systems (AICAS)
- Reviewer, IEIE Transactions on Smart Processing and Computing

•2022
- Program Committee, The 40th IEEE International Conference on Computer Design (ICCD)
- Reviewer, Elsevier Microelectronics Journal
- Reviewer, IEEE Conference on Artificial Intelligence Circuits and Systems (AICAS)

•2021
- Reviewer, Material Research Bulletin, Journal, Elsevier
- Technical Program Committee, IEEE /IEIE International Conference on Consumer Electronics Asia (ICCE-ASIA)
- Reviewer, IEIE Transactions on Smart Processing and Computing

Awards

- Best Paper Runner-Up, MICRO 2023.
- First Prize in Haedong Best Paper Award (Academic Research Work), South Korea, Nov. 2021.

Invited Talks

- "*Towards Large-Scale Computing Systems via Resource Disaggregation*," Seoul National University of Science and Technology, South Korea, Dec. 2024
- "*Disaggregation and its Security for Large-Scale Computing Systems*," Korea University, South Korea, Aug. 2023.
- "*CXL-enabled Sharing in a Multi-Host Disaggregated Memory System*," Seoul National University GoGE Workshop: Future Generation Security Computing Systems, Aug. 2023.
- "*Introduction to Computer Architecture Simulators and Use of Gem5*," North Carolina State University (ECE 096), United States, Mar. 2023.
- "*Bitwidth Reduction of Write Counters of Wear Leveling in a Phase-Change Memory System*," KSPC, South Korea, Sep. 2022.
- "*Introduction to Computer Architecture Simulators and Examples*," University of Seoul, South Korea, Jun. 2022.

Teaching Lectures

•VLSI System Design
- Forth year undergraduate class
- Teaching years: 2024, 2025

•Digital System Design
- Third year undergraduate class
- Teaching years: 2024, 2025

•Computer Organization and Architecture
- Third year undergraduate class
- Teaching years: 2024, 2025

Technical Skills

Programming: C++, C, Verilog, Python
Architecture Simulators: NVMain, PCMCsim, DRAMsim3, McSimA+, MacSim, gem5, SST
Commercial Software: ModelSim, Vivado, Quartus
Hardware Interface (Transaction Level): AXI-Lite/-Full/-Stream, CXL, PCIe, I2C, JEDEC DDRx
Languages: English (Professional working proficiency), Korean (Native), Chinese (Bilingual)