

# Hyun Kim

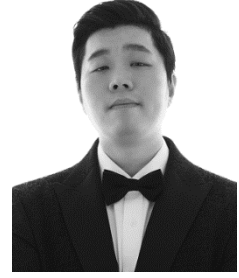
Associate Professor

Department of Electrical and Information Engineering

Seoul National University of Science and Technology, Seoul, Republic of Korea

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Google Scholar: <https://scholar.google.co.kr/citations?user=mCuJPIUAAAJ&hl>



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## Research Interests

- **Digital system (SoC) design for Deep Neural Networks (AI accelerator design)**
- **Performance optimization for Deep Neural Networks**
- **Computer Architecture and Memory System Design for Deep Neural Networks**
- **Artificial Intelligence (AI) applications: Autonomous driving & Smart Factory**
- **High throughput and low power FPGA design for multimedia applications**

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## Education

- *Ph.D.* in Electrical and Computer Engineering (2015.02.), **Seoul National University**, Seoul, Korea
  - “H.264-based Low Power Heterogeneous Video Recording System”, Advisor: Hyuk-Jae Lee
- *M.S.* in Electrical and Computer Engineering (2011.02.), **Seoul National University**, Seoul, Korea
  - “Power-Aware Design with Various Low-Power Algorithms for an H.264/AVC Encoder”, Advisor: Hyuk-Jae Lee
- *B.S.* in Electrical Engineering (2009.02), **Seoul National University**, Seoul, Korea

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## Work Experience

- *Associate Professor* - Department of Electrical and Information Engineering, **Seoul National University of Science and Technology**, Seoul, Republic of Korea (2022.10. ~ Present)
- *Associate Director* - Research and Industry-University Cooperation Foundation, **Seoul National University of Science and Technology**, Seoul, Republic of Korea (2022.12. ~ 2023.12.)
- *Associate Director* - Leaders in INdustry-university Cooperation Center, **Seoul National University of Science and Technology**, Seoul, Republic of Korea (2022.12. ~ 2023.12.)
- *Assistant Professor* - Department of Electrical and Information Engineering, **Seoul National University of Science and Technology**, Seoul, Republic of Korea (2018.09. ~ 2022.09.)
- *Assistant Professor* - BK21 Creative Research Engineer Development for IT, **Seoul National University**, Seoul, Republic of Korea (2016.03. ~ 2018.08.)
- *Post Doctorial Fellow* - BK21 Creative Research Engineer Development for IT, **Seoul National University**, Seoul, Republic of Korea (2015.03. ~ 2016.02.)

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## Professional Activities

- Senior Member, Institute of Electrical and Electronics Engineers (IEEE)
- Member, IEEE Circuits and Systems Society & IEEE Computer Society
- Board of Executive Director, The Institute of Electronics and Information Engineers (IEIE)
- Cooperative Director, IEIE Semiconductor Society
- Life Member, IEIE
- Associate Editor, IEIE Transactions on Smart Processing and Computing
- Topic Editor, Electronics
- Peer Review for the Journals: 1) IEEE Transactions on Circuits and Systems for Video Technology, 2) IEEE Transactions on Circuits and Systems I: Regular Papers, 3) IEEE Transactions on Circuits and Systems II: Express Briefs, 4) IEEE Transactions on Computers, 5) IEEE Transactions on Very Large Scale Integration (VLSI) Systems, 6) IEEE Transactions on Neural Networks and Learning Systems, 7) IEEE Transactions on Emerging Topics in Computing, 8) IEEE Transactions on Instrumentation & Measurement, 9) IEEE Transactions on Consumer Electronics, 10) IEEE Access, 11) IEEE Signal Processing Letters, 12) IEEE Embedded Systems Letters, 13) Neurocomputing, 14) IEIE Journal of Semiconductor Technology and Science
- Peer Review for the Conferences: 1) Conference on Neural Information Processing Systems (NeurIPS), 2) IEEE International Conference on Machine Learning (ICML), 3) International Conference on Learning Representations (ICLR), 4) AAAI Conference on Artificial Intelligence (AAAI), 5) IEEE/CVF Computer Vision and Pattern Recognition Conference (CVPR), 6) International Conference on Computer Design (ICCD), 7) IEEE International Conference on Artificial Intelligence Circuits and Systems (AICAS), 8) IEEE International Symposium on Circuits and Systems (ISCAS)
- Organizing/Technical Program Committee (International Conference)
  - 1) International Conf. on Electronics, Information, and Communication 2024 (TPC Chair)
  - 2) IEEE/IEIE The Sixth International Conference on Consumer Electronics Asia 2021 (OC Co-Chair)
  - 3) 29th Asia and South Pacific Design Automation Conference (ASP-DAC) (Design Contest Chair)
  - 4) 2023-2024 IEEE CASS Student Design Competition
  - 5) The 20th International SoC Design Conference (ISOCC 2023)
  - 6) IEEE International Symposium on Integrated Circuits and Systems (ISICAS 2023)
  - 7) International Conf. on Electronics, Information, and Communication 2023
  - 8) The 19th International SoC Design Conference (ISOCC 2022)
  - 9) IEEE International Conference on Artificial Intelligence Circuits and Systems (AICAS) 2022
  - 10) IEEE Seoul Section Student Paper Contest 2021
  - 11) International Conf. on Electronics, Information, and Communication 2020
- Organizing/Technical Program Committee (Domestic Conference)
  - 1) The 5th Future and Challenges of Memory-Centric Computers Workshop

- 2) IEIE SoC Conference 2023
- 3) The 30th Korean Conference on Semiconductors (KCS 2023)
- 4) The 4th Future and Challenges of Memory-Centric Computers Workshop
- 5) The 29th Korean Conference on Semiconductors (KCS 2022)
- 6) The 3rd Future and Challenges of Memory-Centric Computers Workshop
- 7) IEIE SoC Conference 2021
- 8) IEIE Summer Conf. 2018

- Verification Committee Member, Employment Examination for Seoul Civil Servant
- TF Committee Member, Intelligent Semiconductor Forum
- Session Chair: 1) IEIE Summer Conf. 2023, 2) International Conf. on Electronics, Information, and Communication 2023, 3) Autumn Annual Conf. of IEIE 2022, 4) IEIE Summer Conf. 2022, 5) IEEE International Symposium on Circuits and Systems 2022, 6) International Conf. on Electronics, Information, and Communication 2022, 7) Autumn Annual Conf. of IEIE 2021, 8) IEIE SoC Conf. 2021, 9) IEIE Summer Conf. 2021, 10) The 3rd Future and Challenges of Memory-Centric Computers Workshop, 11) IEIE Summer Conf. 2020, 12) International Conf. on Electronics, Information, and Communication 2020, 13) IEIE Summer Conf. 2019, 14) IEIE Summer Conf. 2018, 15) International Conf. on Electronics, Information, and Communication 2017, 16) IEEE/IEIE International Conf. on Consumer Electronics 2016, 17) IEIE Summer Conf. 2016

## **Awards / Honors**

- Haedong Young Engineer Award, HAEDONG SCIENCE FOUNDATION, 2023
- Best Student Paper Award with Bronze Prize, IEEE Seoul Section Student Paper Contest, 2023
- Best Student Paper Award with Bronze Prize, IEEE Seoul Section Student Paper Contest, 2023
- Best Student Paper Award with Bronze Prize, IEEE Seoul Section Student Paper Contest, 2023
- Excellence Award, 2023 WISSET, IEIE
- Outstanding Associate Editor Award, IEIE Transactions on Smart Processing and Computing, 2023
- 2022-2023 Student Design Competition Winner in Asia, Australia, and the Pacific, IEEE Circuits and Systems Society, 2023
- Best Student Paper Award with Grand Prize, IEEE Seoul Section Student Paper Contest, 2022
- Best Student Paper Award with Bronze Prize, IEEE Seoul Section Student Paper Contest, 2022
- Best Student Paper Award with Bronze Prize, IEEE Seoul Section Student Paper Contest, 2022
- Achievement Award, IEIE, 2021
- First Prize, Haedong Best Paper Award, 2021
- Best Paper Award Silver Prize, IEEE/IEIE ICCE-ASIA, 2021
- Outstanding Achievement Award in Education, Seoul National University of Science and Technology, 2020

- Bronze Award, 2020 AI Training Data [Dynamic Object Detection AI Data] Online Hackathon, 2020
  - Bronze Award, 2020 AI Training Data [Road Driving Video AI Data] Online Contest, 2020
  - Best Paper Award Silver Prize, ICEIC, 2020
  - Best Paper Award, Autumn Annual Conference of IEIE, 2019
  - Elected as an IEIE new researcher (2017)
  - NAVER Best Paper Award, 2017 IEIE Summer Conference
  - Excellence Award, 5th SoC Design Competition hosted by SNU SoC Design Technology Center
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### Lab (Intelligent Digital Systems Design Lab) Status (Sep. 2023)

- Post-Doc: 1, Ph.D Course: 8, M.S. Course: 9, Research Staffs: 1, Research Intern: 4
  - Ph.D graduates: 0, M.S. graduates: 11, Undergraduate graduates: 11
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### International Journal Publications (\* : Corresponding Author)

- **Submitted**

- Juntae Park and Hyun Kim\*, "CAS: A Scalable and Power-Efficient FPGA Implementation of CNN Accelerators Optimized for Skip Connection," *IEEE Transactions on Circuits and Systems II: Express Briefs*.
- Jong Ho Lee and Hyun Kim\*, "DCT-ViT: High-Frequency Pruned Vision Transformer with Discrete Cosine Transform," *IEEE Access*.
- Hyeonseok Hong and Hyun Kim\*, "VFT: A Versatile Fine-Tuning Scheme based on Feature Distribution-aware Knowledge Distillation for Lightweight Convolutional Neural Networks," *Engineering Applications of Artificial Intelligence*.
- Kwanghyun Koo, Seungil Lee, Jong Ho Lee, Gilha Lee, Sangbeom Jeong, Seong Jun O, and Hyun Kim\*, "Vision Transformer Models for Mobile/Edge Devices: A Survey," *Multimedia Systems*.
- Dahun Choi, Hyunseock Hong, Namjoon Kim, Haein Lee, Beomjin Kang, Huibeom Kang, and Hyun Kim\*, "A Survey of CNN Accelerators on FPGA Platforms: Architectures and Optimization Techniques," *Journal of Real-Time Image Processing*.
- Seungyong Lee, Sanghyun Lee, Minseok Seo, Chunmyung Park, Woojae Shin, Hyuk-Jae Lee, and Hyun Kim\*, "NPC: A Non-conflicting Processing-in-memory Controller in DDR Memory Systems," *IEEE Transactions on Computers*.
- Seung-Hwan Bae, Hyuk-Jae Lee, and Hyun Kim\*, "MCM-SR: Multiple Constant Multiplication-based CNN Streaming Hardware Architecture for Super-Resolution," *IEEE Transactions on Circuits and Systems for Video Technology*.

- **Published** (Sort by publication date)

1. Dayoung Chun, Seung Il Lee, and Hyun Kim\*, "Uncertainty-based One-phase Learning to Enhance Pseudo Label Reliability for Semi-supervised Object Detection," *IEEE Transactions on Multimedia*.
2. Nam Joon Kim and Hyun Kim\*, "Trunk Pruning: Highly Compatible and Versatile Channel Pruning

Without Fine-Tuning,” *IEEE Transactions on Multimedia*.

3. Jeong Jun Lee and Hyun Kim\*, “Multi-step Training Framework Using Sparsity Training for Efficient Utilization of Accumulated New Data,” *IEEE Access*, Vol. 11, pp. 129613-129622, 2023.
4. Kwanghyun Koo and Hyun Kim\*, “V-SKP: Vectorized Kernel-based Structured Kernel Pruning for Accelerating Deep Convolutional Neural Networks,” *IEEE Access*, Vol. 11, pp. 118547-118557, 2023.
5. Nam Joon Kim and Hyun Kim\*, “FP-AGL: Filter Pruning with Adaptive Gradient Learning for Accelerating Deep Convolutional Neural Networks,” *IEEE Transactions on Multimedia*, Vol. 25, pp. 5279-5290, 2023.
6. Ji Hoon Jang, Jin Shin, Juntae Park, Inseong Hwang, and Hyun Kim\*, “An In-depth Survey of Processing-in-Memory Architectures for Deep Neural Networks,” *Journal of Semiconductor Technology and Science*, Vol. 70, No. 10, pp. 3882-3886, Oct. 2023.
7. Subin Ki, Juntae Park, and Hyun Kim\*, “Dedicated FPGA Implementation of the Gaussian TinyYOLOv3 Accelerator,” *IEEE Transactions on Circuits and Systems II: Express Briefs*, Vol. 70, No. 10, pp. 3882-3886, Oct. 2023.
8. Jin Shin, Jong Ho Lee, and Hyun Kim\*, “LL-FMC: Low-latency Frame Memory Compression Scheme with High Reconstructed Quality,” *IET Electronics Letters*, Vol. 59, No. 14, pp. e12893, Jul. 2023.
9. Dayoung Chun, Jiwoong Choi, Hyuk-Jae Lee, and Hyun Kim\*, “CP-CNN: Computational Parallelization of CNN-based Object Detectors in Heterogeneous Embedded Systems for Autonomous Driving,” *IEEE Access*, Vol. 11, pp. 52812-52823, May 2023.
10. Hyocheon Lee, Seungyong Lee, Byeongki Song, Moonsoo Kim, Seokbo Shim, Hyuk-Jae Lee, and Hyun Kim\*, “An In-Module Disturbance Barrier for Mitigating Write Disturbance in Phase-Change Memory,” *IEEE Transactions on Computers*, Vol. 72, No. 4, pp. 1150-1162, Apr. 2023.
11. Jongho Lee and Hyun Kim\*, “Discrete Cosine Transformed Images Are Easy To Recognize in Vision Transformer,” *IEIE Transactions on Smart Processing & Computing*, Vol. 12, No. 1, pp. 48-54, Feb. 2023.
12. Jeong Jun Lee and Hyun Kim\*, “Versatile Kernel Reactivation for Deep Convolutional Neural Networks,” *IET Electronics Letters*, Vol. 58, No. 19, pp. 723-725, Sep. 2022.
13. Jiwoong Choi, Dayoung Chun, Hyuk-Jae Lee, and Hyun Kim\*, “Efficient Object Detection Acceleration Methods for Autonomous-Driving Embedded Platforms,” *IEIE Transactions on Smart Processing & Computing*, Vol. 11, No. 4, pp. 255-261, Aug. 2022.
14. Hyocheon Lee, Hyuk-Jae Lee, and Hyun Kim\*, “A Read Disturbance Tolerant Phase Change Memory System for CNN Inference Workloads,” *Journal of Semiconductor Technology and Science*, Vol. 22, No. 4, pp. 216-223, Aug. 2022.
15. Hyun Kim\*, “Review of Optimal Convolutional Neural Network Accelerator Platforms for Mobile Devices,” *Journal of Computing Science and Engineering*, Vol. 16, No. 2, pp. 113-119, Jun. 2022.
16. Moonsoo Kim, Hyocheon Lee, Hyun Kim\*, and Hyuk-Jae Lee, “WL-WD: Wear-Leveling Solution to Mitigate Write Disturbance Errors for Phase-Change Memory,” *IEEE Access*, Vol. 10, pp. 11420-11431, Jan. 2022.
17. Jeong Jun Lee, Ji Hoon Jang, Jin Hong Lee, Dayoung Chun, and Hyun Kim\*, “CNN-based Mask-Pose Fusion for Detecting Specific Persons on Heterogeneous Embedded Systems,” *IEEE Access*,

Vol. 9, pp. 120358-120366, Sep. 2021.

18. Jin Shin and Hyun Kim\*, "RL-SPIHT: Reinforcement Learning based Adaptive Selection of Compression Ratio for 1-D SPIHT Algorithm," *IEEE Access*, Vol. 9, pp. 82485-82496, Jun. 2021.
19. Duy Thanh Nguyen, Hyun Kim\*, and Hyuk-Jae Lee, "Layer-specific Optimization for Mixed Data Flow with Mixed Precision in FPGA Design for CNN-based Object Detectors," *IEEE Transactions on Circuits and Systems for Video Technology*, Vol. 31, No. 6, pp. 2450-2464, Jun. 2021.
20. Seungyong Lee, Hyeok Lee, Hyuk-Jae Lee, and Hyun Kim\*, "Evaluation of Various Workloads in Filebench Suitable for Phase-Change Memory," *IEIE Transactions on Smart Processing & Computing*, Vol. 10, No. 2, pp. 160-166, Apr. 2021.
21. Duy Thanh Nguyen, Hyun Kim\*, and Hyuk-Jae Lee, "An Approximate DRAM Design with an Adjustable Refresh Scheme for Low-Power Deep Neural Networks," *Journal of Semiconductor Technology and Science*, Vol. 21, No. 2, pp. 134-142, Apr. 2021.
22. Quan-Dung Pham, Xuan Truong Nguyen, Khac-Thai Nguyen, Hyun Kim\*, and Hyuk-Jae Lee, "MLS: An MAE-aware LiDAR sampling framework in On-road Environments using Spatio-Temporal information," *IEEE Sensors Journal*, Vol. 21, No. 7, pp. 9389-9401, Apr. 2021.
23. Moonsoo Kim, Juhan Lee, Hyun Kim\*, and Hyuk-Jae Lee, "An Optimal On-Demand Scrubbing Solution for Read Disturbance Errors in Phase-Change Memory," *IEIE Transactions on Smart Processing & Computing*, Vol. 10, No. 1, pp. 55-60, Feb. 2021.
24. Sungrae Kim and Hyun Kim\*, "Zero-Centered Fixed-Point Quantization with Iterative Retraining for Deep Convolutional Neural Network-Based Object Detectors," *IEEE Access*, vol. 9, pp. 20828-20839, 2021.
25. Xuan Truong Nguyen, Hyun Kim, and Hyuk-Jae Lee\*, "An Efficient Sampling Algorithm with K-NN Expanding Operator for Depth Data Acquisition in a LiDAR System," *IEEE Transactions on Circuits and Systems for Video Technology*, Vol. 30, No. 12, pp. 4700-4714, Dec. 2020.
26. Xuan Truong Nguyen, Tuan Nghia Nguyen, Hyuk-Jae Lee, and Hyun Kim\*, "An Accurate Weight Binarization Scheme for CNN Object Detectors with Two Scaling Factors," *IEIE Transactions on Smart Processing & Computing*, Vol. 9, No. 6, pp. 413-419, Dec. 2020.
27. Hyeok Lee, Hyunmin Jung, Hyuk-Jae Lee, and Hyun Kim\*, "Bit width Reduction of Write Counters for Wear Leveling in a Phase-Change Memory System," *IEIE Transactions on Smart Processing & Computing*, Vol. 9, No. 5, pp. 413-419, Oct. 2020.
28. Xuan Truong Nguyen, Hyun Kim\*, and Hyuk-Jae Lee, "A Gradient-Aware Line Sampling Algorithm for LiDAR Scanners," *IEEE Sensors Journal*, Vol. 20, No. 16, pp. 9283-9292, Aug. 2020.
29. Duy Thanh Nguyen, Nguyen Huy Hung, Hyun Kim\*, and Hyuk-Jae Lee, "An Approximate Memory Architecture for Energy Saving in Deep Learning Applications," *IEEE Transactions on Circuits and Systems I*, Vol. 67, No. 5, pp. 1588-1601, May 2020.
30. Jinwoo Park, Hyeok Lee, Boyeal Kim, Dong-Goo Kang, Seung Oh Jin, Hyun Kim\*, and 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 (VLSI) Systems*, Vol. 28, No. 1, pp. 101-114, Jan. 2020.
31. Hyeok Lee, Moonsoo Kim, Hyunchul Kim, Hyun Kim\*, and Hyuk-Jae Lee, "Integration and Boost of Read-Modify-Write Module in Phase Change Memory System," *IEEE Transactions on Computers*, Vol. 68, No. 12, pp. 1772-1784, Dec. 2019.

32. Xuan Truong Nguyen, Khac-Thai Nguyen, Hyun Kim\*, and Hyuk-Jae Lee, "ROI-based LiDAR Sampling Algorithm in On-road Environment for Autonomous Driving," *IEEE Access*, Vol. 7, No. 1, pp. 90243-90253, Dec. 2019.
33. Moonsoo Kim, Jungwoo Choi, Hyun Kim\*, and Hyuk-Jae Lee, "An Effective DRAM Address Remapping for Mitigating Rowhammer Errors," *IEEE Transactions on Computers*, Vol. 68, No. 10, pp. 1428-1441, Oct. 2019.
34. Duy Thanh Nguyen, Tuan Nghia Nguyen, Hyun Kim\*, and Hyuk-Jae Lee, "A High-Throughput and Power-Efficient FPGA Implementation of YOLO CNN for Object Detection," *IEEE Transactions on Very Large Scale Integration (VLSI) Systems*, Vol. 27, No. 8, pp. 1861-1873, Aug. 2019.
35. Jiwoong Choi, Boyeal Kim, Hyun Kim\*, and Hyuk-Jae Lee, "A High-Throughput Hardware Accelerator for Lossless Compression of a DDR4 Command Trace," *IEEE Transactions on Very Large Scale Integration (VLSI) Systems*, Vol. 27, No. 1, pp. 92-102, Jan. 2019.
36. Hyun Kim, Albert No, and Hyuk-Jae Lee, "SPIHT Algorithm with Adaptive Selection of Compression Ratio Depending on DWT Coefficients," *IEEE Transactions on Multimedia*, Vol. 20, No. 12, pp. 3200-3211, Dec. 2018.
37. Hyun Kim, Hyuk-Jae Lee, and Ik-joon Chang, "Optimal Selection of SRAM Bit-Cell Size for Power Reduction in Video Compression," *IEEE Journal on Emerging and Selected Topics in Circuits and Systems*, Vol. 8, No. 3, pp. 431-443, Sep. 2018.
38. Konstantin Bick, Duy Thanh Nguyen, Hyuk-Jae Lee, and Hyun Kim\*, "Fast and Accurate Memory Simulation by Integrating DRAMSim2 into McSimA+," *MDPI Electronics*, Vol. 7, No. 8, 152, Aug. 2018.
39. Xuan Truong Nguyen, Hyun Kim\*, and Hyuk-Jae Lee, "A Low-cost Hardware Design of a 1D SPIHT Algorithm for Video Display Systems," *IEEE Transactions on Consumer Electronics*, Vol. 64, No. 1, pp. 44-52, Jan. 2018.
40. Xuan Truong Nguyen, Dinh Van Luan, Hyun Kim\*, and Hyuk-Jae Lee, "A High-Definition LIDAR System Based on Two-Mirror Deflection Scanners," *IEEE Sensors Journal*, Vol. 18, No. 2, pp. 559-568, Jan. 2018.
41. Hyun Kim and Hyuk-Jae Lee, "A Low-Power Surveillance Video Coding System with Early Background Subtraction and Adaptive Frame Memory Compression," *IEEE Transactions on Consumer Electronics*, Vol. 63, No. 4, pp. 359-367, Nov. 2017.
42. Hyun Kim, Chae Eun Rhee, and Hyuk-Jae Lee, "A Low-Power Video Recording System with Multiple Operation Modes for H.264 and Light-Weight Compression," *IEEE Transactions on Multimedia*, Vol. 18, No. 4, pp. 603-613, Apr. 2016.
43. Sunwoong Kim, Donghyeon Lee, Hyun Kim, Nguyen Xuan Truong, and Jin-Sung Kim, "An enhanced one-dimensional SPIHT algorithm and its implementation for TV systems," *Displays*, Vol. 40, pp. 68-77, Dec. 2015.
44. Hyun Kim, Chae Eun Rhee, and Hyuk-Jae Lee, "An Effective Combination of Power Scaling for H.264/AVC Compression," *IEEE Transactions on Very Large Scale Integration (VLSI) Systems*, Vol. 23, No. 11, pp. 2685-2689, Nov. 2015.

- **Submitted**

- Ji Hoon Jang, Hyeon Lee, and Hyun Kim\*, “EDeN: Enabling Low-Power CNN Inference on Edge Devices using Prefetcher-assisted NVM Systems,” *61st ACM/IEEE Design Automation Conference (DAC 2024)*. (IF: 3, NRF BK21+)
- Dahun Choi, Juntae Park, and Hyun Kim\*, “HLQ: Hardware-Friendly Logarithmic Quantization for Power-Efficient Low-Precision CNN Training,” *61st ACM/IEEE Design Automation Conference (DAC 2024)*. (IF: 3, NRF BK21+)
- Jin Shin and Hyun Kim\*, “DEL: Domain Embedding Layer Using Discrete Wavelet Transform for Single Domain Generalization,” *The Forty-first International Conference on Machine Learning (ICML 2024)*. (IF: 4, NRF BK21+)
- Nam Joon Kim, Jong Ho Lee, and Hyun Kim\*, “HyQ: Hardware-Friendly Post-Training-Quantization for CNN-Transformer Hybrid Networks,” *The 33rd International Joint Conference on Artificial Intelligence (IJCAI 2024)*. (IF: 4, NRF BK21+)
- Sangbeom Jeong, Dahun Choi, and Hyun Kim, “SRU-Q: Hardware-friendly Stochastic Rounding Unit-based Gradient Quantization for CNN Training,” *6th IEEE International Conference on Artificial Intelligence Circuits and Systems (AICAS 2024)*.
- Gilha Lee, Seung Il Lee, and Hyun Kim, “ACC: Adaptive Compression Framework for Efficient On-device CNN Training,” *6th IEEE International Conference on Artificial Intelligence Circuits and Systems (AICAS 2024)*.
- Dayoung Chun, Hyuk-Jae Lee, and Hyun Kim, “PF-Training: Parameter Freezing for Efficient On-Device Training of CNN-Based Object Detectors in Low-Resource Environments,” *6th IEEE International Conference on Artificial Intelligence Circuits and Systems (AICAS 2024)*.
- Dahun Choi and Hyun Kim, “ARC: Adaptive Rounding and Clipping Considering Gradient Distribution for Deep Convolutional Neural Network Training,” *IEEE International Symposium on Circuits and Systems (ISCAS 2024)*.

- **Published** (Sort by publication date)

1. Seung Il Lee and Hyun Kim, “Enhancing Pseudo-labeling Performance in Object Detection Using Gaussian Mixture Modeled Uncertainty,” *2024 International Conference on Electronics, Information, and Communications (ICEIC 2024)*, Jan. 2024.
2. Dahun Choi and Hyun Kim, “GDS: Gradient Distribution Scaling-based Gradient Quantization for Low-complexity and Hardware-friendly Training of Instance Segmentation Models,” *2024 International Conference on Electronics, Information, and Communications (ICEIC 2024)*, Jan. 2024.
3. Hyeon Seok Hong and Hyun Kim, “Implementation of Tiled Point-wise Convolution in MobileNet for Parallel Processing,” *2024 International Conference on Electronics, Information, and Communications (ICEIC 2024)*, Jan. 2024.
4. Inseong Hwang, Jihoon Jang, and Hyun Kim, “An Architecture-level Framework for Enabling Processing-Using-Memory Simulations in Deep Neural Networks,” *2024 International Conference on Electronics, Information, and Communications (ICEIC 2024)*, Jan. 2024.
5. Kwanghyun Koo and Hyun Kim, “Extreme Pruning Technique Based on Filter Deactivation using Sparsity Training for Deep Convolutional Neural Networks,” *2024 International Conference on Electronics, Information, and Communications (ICEIC 2024)*, Jan. 2024.



6. Jin Shin and Hyun Kim, "A Simplified Feature Alignment Strategy for Image Classification Across Domains," *2024 International Conference on Electronics, Information, and Communications (ICEIC 2024)*, Jan. 2024.
7. Beom Jin Kang, Dahun Choi, and Hyun Kim, "Mixed Precision Quantization with Hardware-friendly Activation Functions for HybridViT Models," *2024 International Conference on Electronics, Information, and Communications (ICEIC 2024)*, Jan. 2024.
8. Beom Jin Kang, Nam Joon Kim, Jong Ho Lee, and Hyun Kim\*, "Hardware-friendly Activation Functions for HybridViT Models," *20th International SoC Design Conference (ISOCC 2023)*, Oct. 2023.
9. Ji Hoon Jang, Hyeon Lee, and Hyun Kim\*, "A Spatio-Temporal Switchable Data Prefetcher for Convolutional Neural Networks," *20th International SoC Design Conference (ISOCC 2023)*, Oct. 2023.
10. Seung Il Lee, Sangbeom Jeong, and Hyun Kim, "Design of a High-Performance Instance Segmentation Model Using Uncertainty-Guided Non-Maximum Suppression and Normalization," *2023 The 23rd International Conference on Control, Automation and Systems (ICCAS 2023)*, Oct. 2023.
11. Mengxi Liu, Bo Zhou, Zimin Zhao, Hyeonseok Hong, Hyun Kim, Sungho Suh, Vitor Fortes Rey, and Paul Lukowicz\*, "FieldHAR: A Fully Integrated End-to-end RTL Framework for Human Activity Recognition with Neural Networks from Heterogeneous Sensors," *34th IEEE International Conference on Application-specific Systems, Architectures and Processors (ASAP2023)*, Jul. 2023.
12. Kwanghyun Koo and Hyun Kim\*, "PPT-KP: Pruning Point Training-based Kernel Pruning for Deep Convolutional Neural Networks," *5th IEEE International Conference on Artificial Intelligence Circuits and Systems (AICAS 2023)*, Jun. 2023.
13. Gilha Lee, Nam Joon Kim, and Hyun Kim\*, "GPiL: Gradients with Pseudoinverse Learning for High Accuracy Fine-Tuning," *5th IEEE International Conference on Artificial Intelligence Circuits and Systems (AICAS 2023)*, Jun. 2023.
14. Nam Joon Kim and Hyun Kim\*, "RepSGD: Channel Pruning Using Reparameterization for Accelerating Convolutional Neural Networks," *IEEE International Symposium on Circuits and Systems (ISCAS 2023)*, May 2023.
15. Seung Il Lee, Dayoung Chun, and Hyun Kim\*, "UCR-SSL: Uncertainty-Based Consistency Regularization for Semi-Supervised Learning," *2023 International Conference on Electronics, Information, and Communications (ICEIC 2023)*, Feb. 2023.
16. Nam Joon Kim and Hyun Kim\*, "AGT: Channel Pruning Using Adaptive Gradient Training for Accelerating Convolutional Neural Networks," *2023 International Conference on Electronics, Information, and Communications (ICEIC 2023)*, Feb. 2023.
17. Jin Shin and Hyun Kim\*, "DWT+DWT: Deep Learning Domain Generalization Techniques Using Discrete Wavelet Transform With Deep Whitening Transform," *2023 International Conference on Electronics, Information, and Communications (ICEIC 2023)*, Feb. 2023.
18. Ji Hoon Jang, Hyeon Lee, and Hyun Kim\*, "Characterizing Memory Access Patterns of Various Convolutional Neural Networks for Utilizing Processing-In-Memory," *2023 International Conference on Electronics, Information, and Communications (ICEIC 2023)*, Feb. 2023.
19. Hyeon Seok Hong and Hyun Kim\*, "Feature Distribution-based Knowledge Distillation for Deep Neural Networks," *19th International SoC Design Conference (ISOCC 2022)*, Oct. 2022.

20. Ji Hoon Jang, Hyeon Lee, and Hyun Kim\*, "Performance Analysis of Phase Change Memory System on Various CNN Inference Workloads," *19th International SoC Design Conference (ISOCC 2022)*, Oct. 2022.
21. Seung Il Lee and Hyun Kim\*, "GaussianMask: Uncertainty-aware Instance Segmentation based on Gaussian Modeling," *26th International Conference on Pattern Recognition (ICPR 2022)*, Aug. 2022. (IF: 1, NRF BK21+)
22. Sungrae Kim and Hyun Kim\*, "Power-Efficient Double-Cyclic Low-Precision Training for Convolutional Neural Networks," *4th IEEE International Conference on Artificial Intelligence Circuits and Systems (AICAS 2022)*, Jun. 2022.
23. Dahun Choi and Hyun Kim\*, "Hardware-Friendly Logarithmic Quantization with Mixed-Precision for MobileNetV2," *4th IEEE International Conference on Artificial Intelligence Circuits and Systems (AICAS 2022)*, Jun. 2022.
24. Seungjin Lee and Hyun Kim\*, "DC-MPQ: Distributional Clipping based Mixed-Precision Quantization for Convolutional Neural Networks," *4th IEEE International Conference on Artificial Intelligence Circuits and Systems (AICAS 2022)*, Jun. 2022.
25. Hyeon Lee, Hyeon Suk Kim, Seokbo Shim, Seungyong Lee, Dosun Hong, Hyeon-Jae Lee, and Hyun Kim\*, "PCMCsim: An Accurate Phase-Change Memory Controller Simulator and its Performance Analysis," *2022 IEEE International Symposium on Performance Analysis of Systems and Software (ISPASS 2022)*, May 2022. (IF: 1, NRF BK21+)
26. Subin Ki and Hyun Kim\*, "Activation Distribution-based Layer-wise Quantization for Convolutional Neural Networks," *2022 International Conference on Electronics, Information, and Communications (ICEIC 2022)*, Feb. 2022.
27. Jin Shin and Hyun Kim\*, "Fine-tuned SPIHT Algorithm to Improve Compression Efficiency," *2022 International Conference on Electronics, Information, and Communications (ICEIC 2022)*, Feb. 2022.
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25. Hyun Kim, Jiwoong Choi, Boyeal Kim, Hyuk Jae Lee, Junseo Lee, Changmin Kwak, Youngdo Song, “DATA ENCODER AND DATA ENCODING METHOD,” 미국, 서울대학교 산학협력단, 16/181774, 2019년 12월 3일(등록, US10498358B2).
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28. 김현, 이효근, 김문수, 이혁재, “명령 머지 동작을 수행하는 반도체 메모리 장치 및 그 동작 방법,” 한국, 서울대학교 산학협력단, 10-2019-0049768, 2019년 4월 29일(출원).

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### Invited Talks

- (24 November 2022) “System Semiconductor R&D Items - Mobile/Home Appliances, ” Public Hearing to Discover System Semiconductor R&D Promising Items.
- (3 August 2022) “Digital Systems Design of AI Accelerators for Mobile Devices, ” 2022 Summer Camp in Artificial Intelligence Semiconductor Convergence Training Center.
- (2 June 2022) “Design of Optimal AI Accelerator Platforms for Mobile Devices,” Expert Invited Talk in Incheon National University.
- (13 April 2022) “Design of Mobile AI Accelerator Platforms,” Expert Invited Talk in University of Seoul.
- (16 November 2021) “Towards Optimal Mobile AI Accelerator Platforms,” Expert Invited Talk in Seokyeong University.
- (15 October 2021) “Towards Smarter AI Platforms: Design of Self-Learnable Mobile AI Accelerator Platforms for Autonomous Driving,” Technical Lecture of Institute of Korean Electrical and Electronics Engineers.
- (8 October 2021) “Implementation of Optimal CNN Accelerators for Mobile Devices: Algorithm, Architecture, and Memory System Co-Design,” Special Session of 18th International SoC Design Conference (ISOCC 2021).
- (15 September 2021) “Overview of Mobile AI Accelerators,” CENTRA5.

- (19 August 2021) “Implementation of Self-Learnable Mobile AI Accelerator Platforms for Autonomous Driving, ” Emerging Technology in Electrical and Computer engineering Talks (e-TEC Talks) at Seoul National University Summer 2021.
- (18 August 2021) “Digital Systems Design of AI Semiconductors for Mobile Devices, ” 2021 Summer Camp in Artificial Intelligence Semiconductor Convergence Training Center.
- (20 July 2021) “Digital Systems Design of AI Semiconductor,” Hanyang University IDEC Seminar.
- (08 July 2021) “Co-designing Architectures, Algorithms, and Memory Systems for Mobile AI Accelerators,” 2021 SoC Workshop and Industry-Academic Exchange Meeting.
- (29 April 2021) “Overview, Necessity, and Research Trend of Mobile AI Accelerators,” Korea Industrial Education Institute Seminar on Technology Development, Competitiveness, and Market Analysis in Three Strategic Areas of System Semiconductor.
- (08 February 2021) “Co-designing Architectures, Algorithms, and Memory Systems for AI Accelerators,” Sunmoon University Fourth Industrial Revolution Seminar.
- (27 January 2021) “Implementation of Dedicated Hardware Accelerator for Convolutional Neural Networks Based on Architecture, Algorithm and Memory System Co-Design,” Jeonbuk National University IT Convergence Research Center Seminar.
- (25 January 2021) “Co-designing Architectures, Algorithms, and Memory Systems for Deep Learning Hardware Accelerators,” The 28th Korean Conference on Semiconductors.
- (25 September 2020) “Optimization and Application of AI Semiconductor,” Hanyang University IDEC Seminar.
- (27 August 2020) “Deep Learning Accelerator Design and Its Application,” 2020 Summer Camp in Artificial Intelligence Semiconductor Convergence Training Center.
- (22 July 2020) “Deep Learning Architecture Design and Applications: Deep Learning Accelerator Design and Applications,” Summer Workshop in Institute of Korean Electrical and Electronics Engineers.
- (14 July 2020) “Deep Learning Accelerator Design: Accelerator & Memory Design for DNN and Its Application,” Gwangwoon University IDEC Seminar. 14 July 2020.
- (28 November 2019) “Camera-based Accurate and Fast Object Detector Using Localization Uncertainty for Autonomous Driving,” Seoul National University BK21+ Inter-university Semiconductor Research Center Joint Seminar.
- (17 July 2019) “SoC Design for Deep Learning Accelerator : Deep Learning Hardware Accelerator Design for Autonomous Driving,” Gwangwoon University IDEC Seminar.
- (8 April 2019) “AI Accelerator design & lab,” Hanyang University IDEC Seminar.
- (18 December 2018) “Deep Learning-based Image Processing for Autonomous Driving,” System Semiconductor Technology Exchange Meeting.
- (4 December 2018) “Efficient Memory Design for Deep Neural Network and Its Application,” 2<sup>nd</sup> Expert Invited Talk in Seokyeong University.
- (27 November 2018) “Hardware IP / SoC Design for Deep Neural Network and Its Application,” 1<sup>st</sup> Expert Invited Talk in Seokyeong University.
- (24 October 2018) “Hardware IP / SoC Designs for Autonomous Driving based on Deep Neural

Networks,” 1<sup>st</sup> Semiconductor Industry-Academia Workshop

- (25 July 2018) “Hardware IP / SoC Designs for Low-Complexity Multimedia Processing and Its Application Systems,” Hyundai Motors Open R&D Seminar.
  - (24 November 2017) “Low Power Memory Architecture for Deep Learning Hardware based on Approximation and Compression,” 2017 IEIE Fall Conference.
  - (30 June 2017) “Implementation of Image Processing and Machine Learning based Video Surveillance System,” 2017 IEIE Summer Conference.
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## **Research Funding**

- Development for Processing Software on AI Semiconductor Devices, IITP (2022.07~2029.12)
- Development of phase change memory-based low-power memory platform for DNN inference on mobile devices, NRF (2022.06~2025.02)
- Development of circuits and architecture for 2T DRAM-based low-power and high-performance PIM cells, NRF (2022.04~2024.12)
- Development of Low Power AI Architecture for AIoT, KEIT (2022.04~2024.12)
- Development of reference frame compression/decompression algorithm, Realtek (2021.06~2022.01)
- Multidisciplinary Research Training and Development Enterprise for AI and Semiconductor Technology, NRF (2020.04~2025.12)
- Development of Self-learnable Mobile Recursive Neural Network Processor Technology, NRF (2020.04~2024.12)
- Development of AI Deep-Learning Processor and Module for 2,000 TFLOPS Server, IITP (2020.04~2027.12)
- Cloud-based smart energy town platform integrating energy blocks, NRF (2019.06~2028.02)
- Development of Deep Learning based Low-Power Image Processing SoC Platform for Autonomous Driving, NRF (2019.06~2022.02)
- Embedded implementation of reinforcement learning-based scent, temperature, and humidity control module, Korea Testing Laboratory (2020.10~2020.11)
- Development of deep learning-based open EV platform technology capable of autonomous driving, KEIT (2017.11~2020.12)
- DRAM/PRAM heterogeneous memory architecture and controller IC design technology research and development, KEIT (2017.07~2021.12)
- Real-time mobile traffic information system based on multisensory fusion and integration, IITP (2017.01~2018.08)
- Approximate memory architecture for high performance and low power deep learning hardware, Samsung Research Funding & Incubation Center for Future Technology (2016.12~2019.11)
- Disaster response robots imitate swarm organism and automatic assembly algorithm research, KOFAC (2016.06~2016.11)
- High-Frequency Pruned Vision Transformer with Discrete Cosine Transform, SEOULTECH

(2023.07~2024.06)

- An In-depth Survey of Processing-in-Memory Architectures for Deep Neural Networks, SEOULTECH (2022.10~2023.09)
- A Read Disturbance Tolerant Phase Change Memory System for CNN Inference Workloads, SEOULTECH (2022.06~2023.05)
- Computational Parallelization of Deep Neural Networks on Heterogeneous Embedded Systems for Autonomous Driving, SEOULTECH (2021.09~2022.08)
- CNN-based Mask-Pose Fusion for Detecting Specific Persons on Heterogeneous Embedded Systems, SEOULTECH (2021.08~2022.07)
- An Approximate DRAM Design with an Adjustable Refresh Scheme for Low-power Deep Neural Networks, SEOULTECH (2020.03~2021.02)
- An Effective PRAM Wear-Leveling Algorithm for Reducing Write Disturbance Error, SEOULTECH (2019.03~2020.02)

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### Teaching Experience

- System-on-a-Chip Design for Multimedia, (Spring 2022, Spring 2021, Spring 2019), Seoul National University of Science and Technology
- Hardware Design for Deep Learning, (Fall 2022, Fall 2021, Fall 2020), Seoul National University of Science and Technology
- Deep Learning Hardware Application, (Spring 2023), Seoul National University of Science and Technology
- Topics in Computer and VLSI, (Fall 2023), Seoul National University of Science and Technology
- Digital System Design, (Spring 2023, Spring 2022, Spring 2021, Spring 2020, Spring 2019), Seoul National University of Science and Technology
- Digital Logic Circuit, (Spring 2023, Spring 2022, Spring 2021, Spring 2020), Seoul National University of Science and Technology
- Computer Architecture, (Fall 2023, Fall 2022, Fall 2021, Fall 2020, Fall 2018), Seoul National University of Science and Technology
- Creative Engineering Design, (Fall 2022, Fall 2021, Fall 2020, Fall 2019, Fall 2018), Seoul National University of Science and Technology
- Computational Thinking, (Fall 2019, Spring 2019), Seoul National University of Science and Technology
- Programming language, Spring 2019, Seoul National University of Science and Technology
- Introductory Laboratory for Electrical and Electronic Engineering (1), Spring 2022, Seoul National University of Science and Technology
- Introductory Laboratory for Electrical and Electronic Engineering (2), (Fall 2022, Fall 2021, Fall 2020), Seoul National University of Science and Technology
- Digital System Design and Experiments, (Fall 2017, Fall 2016), Seoul National University



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**Outside Interests**

- Baseball, Golf, Soccer