Junsu Kim

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Research Interests

Computer Architecture, Memory Systems, Systems for ML & ML for Systems

Education

Korea University, Seoul, Korea M.S. in Electrical Engineering (Advisor: Prof. Yunho Oh) Cumulative GPA: 4.0/4.0

Hanyang University, Seoul, Korea B.S. in Electronic Engineering (Advisor: Prof. Ki-Seok Chung) Cumulative GPA: 3.81/4.0 (Graduating with Honors - Summa Cum Laude)

Publications

Conference Papers

[C1] Kwangrae Kim, Jeonghyun Woo, <u>Junsu Kim</u>, and Ki-Seok Chung. "HammerFilter: Robust Protection and Low Hardware Overhead Method for RowHammer". The 39th IEEE International Conference on Computer Design (ICCD), 2021

[Poster] Kwangrae Kim, Junsu Kim, Jeonghyun Woo, and Ki-Seok Chung. "HammerFilter: Robust Protection and Low Hardware Overhead Method for Row-Hammering". The 58th IEEE Design Automation Conference (DAC) Work-in-Progress, 2021

Preprints

[P4] Junsu Kim, and Suhyun Kim. "Saliency-Aware Exemplar Compression for Budgeted Online Continual Learning" Under Review

[P3] Jaebom Jeon, <u>Junsu Kim</u>, Jaeyoung Park, Minsung Gil, Jongmin Kim, Sangun Choi, Gunjae Koo, Myung-Kuk Yoon, and Yunho Oh. "VitBit: Enhancing Embedded GPU Performance for AI Workloads through Register Operand Packing" *Under Review*

[P2] Jongmin Kim, Munsung Gil, Sangun Choi, <u>Junsu Kim</u>, Seondeok Kim, and Yunho Oh. "Exploring Datacenter Workloads: A Comprehensive Behavioral Analysis of CXL Memory Systems" *Under Review*

[P1] Yujin Kim, Minsoo Kang, <u>Junsu Kim</u>, and Suhyun Kim. "Integrative Solution for Catastrophic Forgetting in Model-Only Class Incremental Learning" Under Review

Work Experience

Korea University, Seoul, Korea) Sep. 2022 - Present
Research Assistant at Computer Architecture and System Software Lab (ComSys)	Advisor: Prof. Yunho Oh
Korea Institute of Science and Technology, Seoul, Korea	Jul. 2022 - Aug. 2023
Research Assistant at Korea Data Science Team (KDST)	Supervisor: Dr. Suhyun Kim
Hanyang University, Seoul, Korea	Dec. 2019 - Mar. 2020, Aug. 2020 - Nov. 2020
Research Assistant at Embedded System on Chip Laboratory (ESOC Lab)	Advisor: Prof. Ki-Seok Chung
Research Assistant at Computer Architecture and System SW Lab (CASS Lab)	Advisor: Prof. Yongjun Park
School for the Blind, Chuncheon, Korea Assistant Teacher (Alternative Military Service)	Mar. 2017 - Feb. 2019

Research Projects

Training Emerging AI Alogrithms via GPU Unified Memory-Storage Architecture

Advisor: Prof. Yunho Oh, Korea University

 $\diamond~$ To be appeared

 $\diamond\,$ Tools: UVASim, GPGPUsim, C++, Python

Feb. 2024 - Current

Sep. 2023 - Current

Mar. 2014 - Feb. 2021

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VitBit: Enhancing Embedded GPU Performance for AI Workloads through Register Operand Packing Sep. 2023 - Current

Advisor: Prof. Yunho Oh, Korea University

- \diamond To be appeared
- ♦ Tools: C++, CUDA, Python, Pytorch

Exploring Datacenter Workloads: A Behavioral Analysis of CXL Memory Systems

Advisor: Prof. Yunho Oh, Korea University

- \diamond To be appeared
- ♦ Tools: C, C++, Java, Python (CloudSuite 4.0), Perf, HMSDK

Saliency-Aware Exemplar Compression for Budgeted Online Continual Learning

Supervisor: Dr. Suhyun Kim, Korea Institute of Science and Technology

- \diamond To be appeared
- \diamond Tools: Pytorch, Python

Integrative Solution for Catastrophic Forgetting in Data-Free Class Incremental Learning

Supervisor: Dr. Suhyun Kim, Korea Institute of Science and Technology

- ♦ Data-Free Class Incremental Learning (DFCIL) scenario enables a model to continuously learn without violating privacy
- ♦ Observed previous methods and their synthetic data caused bias in classification head, which exacerbated catastrophic forgetting
- Developed a weight-balancing method to correct the bias in the classification head and a hybrid knowledge distillation approach
- As the third author, proposed the feature distillation scheme, produced the main results, and actively participated in paper writing
- \diamond Tools: Pytorch, Python

HammerFilter: Robust Protection and Low Hardware Overhead Method for RowHammer

Advisor: Prof. Ki-Seok Chung, Hanyang University

- ♦ A recent study showed newer chips are more vulnerable to Rowhammer (i.e., Rowhammer threshold decreased from 139K to 10K)
- ♦ Prior solutions incurred significant area overhead and/or showed imperfect protection
- ◇ Proposed a robust and low overhead RowHammer protection scheme by modifying counting bloom filter
- ♦ As the third author, participated in implementing related works, experiments, and paper writing
- ♦ Tools: DRAMSim2, Gem5, C++, Shell script

Energy-efficient Auto-refresh Skipping Weak Rows

Personal Project

◇ The auto-refresh scheme guarantees all DRAM cells not to lose data with a refresh interval of 64ms

 \diamond RAIDR(ISCA'12) showed fewer than 1000 DRAM cells out of 10¹¹ cells required a refresh interval shorter than 256ms

- ♦ Applied the refresh rate for robust DRAM cells to all DRAM cells based on the assumption modifying OS not to use weak rows.
- ◇ Proposed method averaged 30% improvement of refresh energy over Retention time-aware Intelligent DRAM Refresh (RAIDR)
- ♦ Tools: DRAMSim2, Gem5, C++, Shell script

Optimize Deep Learning Computation on Edge Devices via Compiler

Advisor: Prof. Yongjun Park, Hanyang University

- ♦ Observed the low performance of TASO (SOSP'19) when using CPU
- ◇ First learned the way to think critically, got familiar with research environments (e.g., ubuntu, docker, git)

Coursework Projects

CAPTCHA Project: Building a Machine Reads Distorted Text Hanyang University

♦ Built a framework that classified distorted text with small training data (dataset from Wilhelmy, Rodrigo Rosas, Horacio)

- ♦ Built pre-processing pipeline that detected each letter and applied data augmentation to the training dataset
- ♦ Exploited transfer learning approach to overcome over-fitting
- ♦ Achieved 3rd highest score in the class Kaggle competition and the honor of the best presentation

Implementing HDL Programs on FPGA

Hanyang University

♦ Implemented FIR Filter, LED, seven segments, and VGA controller on Altera DE1-SoC FPGA using Quartus

Embedded System Software Design

Hanyang University

 $\diamond\,$ Cross-compiled bootloader and kernel for Achro 210T board

 $\diamond\,$ Built LED controller for Achro 210T board, and modified the display system

\mathbf{Skills}

Intro to Artificial Intelligence May. 2019 - Jun. 2019

Aug. 2020 - Nov. 2020

Jul. 2020 - Aug. 2020

Dec. 2019 - Mar. 2020

May. 2019 - Jun. 2019

SoC design

Embedded System Design May. 2019 - Jun. 2019

Jan. 2023 - Nov. 2023

Sep. 2023 - Current

May. 2022 - Present