Hyunwon Chung

https://hyunwonch.github.io/

INTERESTS Reconfigurable Computing, CGRA (Coarse-Grained Reconfigurable Architecture), Communication System, In-memory Computing, Deep Learning, VLSI

RESEARCH EXPERIENCE

Graduate Student Research Assistant, University of Michigan
Michigan Integrated Circuits Laboratory (MICL) Jan 2023 – Current

- PROWESS (Processor Reconfiguration for Wideband Sensor Systems)
  - Research on the efficient architecture of Coarse-Grained Reconfigurable Architecture (CGRA) for various application including communication system and machine learning
  - Developing high-throughput, streaming-data processors that reconfigure in real time to detect and characterize novel signals
- DASH-SoC (Domain-Focused Advanced Software Reconfiguration Heterogeneous)
  - Contributed to the development of two accelerators as part of the DARPA-funded DASH project
  - Tape-out submitted for the following accelerators using GF 12nm technology.
- DAP (Domain Adaptive Processor)
  - Enhanced the Domain Adaptive Processor (DAP) by transitioning its bit-width from 16-bit to 32-bit, resulting in a boost in performance
  - Enabled support for a multi-kernel system, ensuring the processor's adaptability to a wide range of communication workloads.
  - Undertook a comprehensive overhaul of the physical design, leading to marked improvements in congestion management and timing, which enhanced the processor's efficiency and performance
- Fully Reconfigurable Accelerator for FEC
  - Designed a highly flexible Reconfigurable Forward Error Correction (FEC) Accelerator that accommodates various standards such as 3GPP LTE/5G, WiFi, and SDA OCT
  - Integrated 6 distinct types of encoders into the system, offering unparalleled flexibility and adaptability to various communication standards.

Supervisors: Prof. David Blaauw and Prof. Hun-Seok Kim

Research Assistant, University of Michigan
Center for Wireless Integrated MicroSensing and Systems (WIMS2) Sep 2022 – Dec 2022

- Contributed to a software and algorithm development specializing in chromatogram analysis, especially in automatic peak detection and baseline correction
- Improved the peak detection algorithm for chromatogram processing based on the continuous wavelet transformation algorithm (Paper accepted to Journal of Chromatography A)
- Supervisor: Prof. Yogesh Gianchandani

Research Assistant, Korea University
VLSI Signal Processing Lab Mar 2020 – Jan 2021

- Accelerator for Communication System
  - Designed JPEG encoding & decoding hardware based on the discrete cosine transform (DCT) and synthesized the RTL using 65nm TSMC technology
  - Designed a low-power hardware architecture for Viterbi decoder
- Deep Learning Acceleartor
  - Proposed 8bit fixed-point low-power accelerator for Convolutional Neural Network
  - Developed two-folded architecture on Fully-Connected Layer for efficient computing
- Supervisor: Prof. Jongsun Park

EDUCATION

University of Michigan, Ann Arbor
PhD. in Electrical and Computer Engineering May 2024 – Current

University of Michigan, Ann Arbor
MS. in Electrical and Computer Engineering Aug 2022 – May 2024
- Cumulative GPA: 4.0 / 4.0

Korea University, Seoul
BS. in Electrical Engineering Mar 2015 – Feb 2022
- Cumulative GPA: 3.99 / 4.5 (Upper 4.11 / 4.5) (Include 2-year military service)

SELECTED PROJECTS

A Dynamic Quantized CNN Processor with Analog MAC Operations
- *EECS 627 course project*
- Designed analog MAC unit which includes digital to pulse converter, analog datapath, and flash ADC
- Proposed dynamic quantization method which allows each layer have different fixed points
- Post-quantization training and quantization-aware training are both used for 5-bit quantization, to get proper accuracy on MNIST and Cifar-10 dataset

16 bit Microprocessor with In-memory computing technology based on 6T SRAM architecture
- *EECS 427 course project*
- Developed 16-bit Microprocessor based on RISC-V ISA, which includes RF, ALU, Controller, Program Counter, Shifter, and IMEM/DMEM
- Designed customized 6T-SRAM based in-memory computing (IMC) module into 16-bit microprocessor

Custom Design Projects
- Implemented 128-bit Lightweight Encryption Algorithm (LEA) Decryption security module using Matlab & Verilog and synthesized it using 90nm TSMC technology
- Developed several circuit design including Inverter Chain, Ring Oscillator, SRAM, 3-tap FIR filter, and Flip-Flops. This includes the schematic, layout, and post-layout simulation

The World Embedded Software Contest - AI Humanoid Division
- Developed a program for real-time image processing and humanoid robot control using python
- Won 3rd place and Awarded Embedded SW & System Industry Association Chairman's award

Computer Architecture Project
- Developed Inverse-matrix program and heap-sort program using ARM assembly language
- Implemented TCP Server-Client program using multi-thread technique in C

SKILLS

Languages : C, C++, MATLAB, Verilog, SystemVerilog, Python, R, Linux, LaTeX
Frameworks : PyTorch, Tensorflow, NumPy, Matplotlib, OpenCV
Hardware Simulation Tool : PSPICE, Design Complier, Model Sim, VCS
Circuit Design Software : Virtuoso, encounter, Innovus, Calibre

MILITARY SERVICE

KATUSA, Korean Augmentation To the United States Army,
Squad Leader, Sergeant, Headquarter, 23rd CBERN, 2ID, Camp Humphreys Sep 2016 – Jun 2018

AWARDS & SCHOLARSHIPS

Dean's list at School of Electrical Engineering , Korea University
- 2021 (Spring Semester)
- 2020 (Spring Semester)
- 2019 (Spring Semester)
- 2018 (Fall Semester)

Miraero Scholarship at School of Electrical Engineering , Korea University
- 2016 (Spring Semester) : Half tuition waived

National Scholarship (Admission with highest distinction), Korea University
- 2015 (Spring Semester) : Half tuition waived

CLUB ACTIVITIES

Hardware and Software, HandS 2018 – 2021

- Participated in numerous competitions as a senior member such as Hackathons, Embedded software competition, and coding competition
- Tutored various courses such as Arduino, Raspberry Pi, and etc.

Electrical Soccer Club & **Basketball Club** 2015 – 2021

- Participated in more than 10 competitions and won several medals
- Participated in Major amateur competitions 4 times and our team ranked up to 6th place nationwide