

ZE-WEI (Johnny) LIOU

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INTERESTS

AI Accelerator Design, Compute-In-Memory (CIM) Systems, Multicore AI Accelerators, Dynamic Inference, Transformer Quantization, VLSI System Design

EDUCATION

Sep 2020 - Jun 2024 National Taiwan University Department of Electrical Engineering

- Last 60 GPA: 4.25 / 4.3
 - Ranked 1st in 3 semesters (1st among 262 in senior year)
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PUBLICATION

[1] Burr, G. W., Tsai, H., Simon, W., Boybat, I., Ambrogio, S., Ho, C.-E., Liou, Z.-W., et al., "Design of Analog-AI Hardware Accelerators for Transformer-based Language Models (Invited)," IEDM, 2023.

[2] Liou, Z.-W., Hong, D.-Y., "Optimizing Compute Core Assignment for Dynamic Batch Inference in AI Inference Accelerator," ACM Symposium on Applied Computing (SAC), 2025. (*submitted*)

RESEARCH EXPERIENCE

CIM Systems

- **Internship | IBM Research Almaden Lab, San Jose, CA, USA** Jun 2023 - Sep 2023
Mentored by Dr. Geoffrey Burr and Dr. HsinYu (Sidney) Tsai

Role of Weight Stationarity in CIM Systems [1]

- Conducted a systematic comparison of encoder-based and decoder-based transformer models.
- Compared system-level differences between fully-weight stationary (NVM) and partially-weight stationary (VM) systems in Bert-base and Bert-large performance.

Architecture Design for Partially-Weight Stationary Systems

- Designed stack-shaped and ring-shaped architectures for partially weight-stationary systems.
- Identified design choices that optimized area-compute efficiency based on user-specific requirements.

Functional Verification

- Implemented functional verification in a CIM simulator (C++) to automatically verify DNN results.

- **Undergraduate Researcher | NTU Access Lab** Jul 2022 - Jul 2023
Mentored by Prof. An-Yeu (Andy) Wu

CIM-aware ViT Quantization

- Resolved the accuracy drop issue in the quantized Vision Transformer by applying the group quantization method to the LayerNorm layer.
- Designed an RRAM-based CIM architecture supporting the group quantization method.

AI Inference Accelerators

- **Research Assistant | Academia Sinica, Taiwan** Feb 2024 - Present
Mentored by Dr. Ding-Yong Hong and Dr. Jan-Jan Wu

Dynamic Batch Inference on multicore AI accelerators [2]

- Developed an algorithm for optimal compute core assignment for dynamic batch inference, where input batch sizes are variable, on multicore AI inference accelerators.
- Achieved an average 3.05x inference speedup compared to the EdgeTPU inference strategy.

Accelerator supporting arbitrary sparsity ratio

- Implement an FPGA-based accelerator supporting arbitrary N:M sparsity ratio in DNNs.
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AWARDS

National Integrated Circuit Design Contest - Second Prize

May 2023

National Taiwan University Dean's List Award

Spring 2023

National Meichu Hackathon - First Prize

Oct 2021

VLSI CIRCUIT DESIGN EXPERIENCE

2D Bilinear Resize Engine

May 2023

Second Prize Award in National Integrated Circuit Design Contest

- Implemented by designing a floating-point bilinear interpolation computation element.
- Conducted RTL coding and logic synthesis, optimizing performance through pipelined implementation.

5G MIMO Demodulation

May 2023 - Jun 2023

Project Designed by MediaTek and National Taiwan University

- Implemented maximum likelihood demodulation in a MIMO receiver through the complete VLSI system design flow, including RTL design, logic synthesis, and placement.
- Achieved second-best area \times power \times time performance in post-layout design among 44 graduate groups.

Real Time FPGA-based Acoustic Imaging

Nov 2022 - Dec 2022

- Implemented a hardware system with a beamforming algorithm on an Altera Cyclone IV FPGA to visualize the location and intensity of sound waves.

Courses

- Achieved A+ grades in several VLSI courses, including Computer-Aided VLSI System Design, Integrated Circuit Design, Digital Signal Processing in VLSI, and Digital Circuit Lab.
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HACKATHON EXPERIENCE

E-Air: Intelligent air conditioner system

Oct 2021

First Prize Award in National Meichu Hackathon

- Obtained human pose data using a model from MediaPipe and then adjusted the speed and swing of the air conditioner model we created.
 - Developed strong problem-solving skills and effectively implemented solutions in practice.
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VOLUNTEER WORK AND AFFILIATIONS

Public Relations Officer | School's Country Youth Service Club

Sep 2021 - Present

- Shared scientific knowledge, including topics such as air pressure and magnetic force, with rural junior high school students through games during each semester's camp.
- Efficiently communicated with service-oriented foundations and rural schools.