

# Hyoukjun Kwon

ASSISTANT PROFESSOR @ UCI (EECS DEPT.)  
3436 Engineering Hall, CA 92697

☎ (+1) 404-539-4457 | ✉ hyoukjun.kwon@uci.edu | 🏠 www.hyoukjunkwon.com | 📺 hyoukjun-kwon

## Professional Experience

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### University of California, Irvine, Irvine, CA

Assistant Professor, EECS

*Jan. 2023 - present*

### Meta (Facebook), Sunnyvale, CA

Research Scientist at Meta (Facebook) Reality Labs  
Manager: Dr. Liangzhen Lai

*Oct. 2020 - Dec. 2022*

### Facebook, Menlo Park, CA

Research Intern at AR/VR AI Research  
Manager: Dr. Vikas Chandra, Mentor: Dr. Liangzhen Lai

*May. 2019 - July. 2019*

### NVIDIA, Westford, MA

Research Intern at Architecture Research Group  
Manager: Dr. Steve Keckler, Mentor: Dr. Michael Pellauer

*May. 2018 - Aug. 2018*

### NVIDIA, Westford, MA

Research Intern at Architecture Research Group  
Manager: Dr. Steve Keckler, Mentor: Dr. Michael Pellauer

*May. 2017 - Aug. 2017*

### Georgia Institute of Technology, Atlanta, GA

Graduate Research Assistant  
Advisor: Prof. Tushar Krishna

*Aug. 2015 - Jul. 2020*

## Education

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### Georgia Institute of Technology

PhD in Computer Science

*Aug. 2015 - Jul. 2020*

- Advisor: Prof. Tushar Krishna and Dr. Michael Pellauer (co-advisor)
- Committee: Prof. Vivek Sarkar, Prof. Hyesoon Kim, and Prof. Alexey Tumanov
- Thesis Title: Data- and Communication-centric Approaches to Model and Design Flexible Deep Neural Network Accelerators
- Honor: Honorable mention, ACM SIGARCH/IEEE CS TCCA Outstanding dissertation award,  
(Selected as one of the three best dissertations in the computer architecture area in 2020)

### Seoul National University (SNU)

BS in CSE (Computer Science and Engineering)  
BS in EMS (Environmental Material Science)

*Mar. 2007 - Feb. 2015*

- Advisor: Prof. Jihong Kim (CSE) and Prof. Junjae Lee (EMS)

## Honors & Awards

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- 2021 **Honorable Mention**, ACM SIGARCH/IEEE CS TCCA Outstanding Dissertation Award 2021
- 2020 **Best Paper Award**, HPCA 2020
- 2020 **Top Pick**, IEEE MICRO Top Picks from 2019 Computer Architecture Conferences
- 2019 **Finalist**, Qualcomm innovation fellowship
- 2019 **Honorable Mention, Top Pick**, IEEE MICRO Top Picks from 2018 Computer Architecture Conferences
- 2018 **Finalist**, ACM Student research competition (SRC) at MICRO 2018

## Research Interests

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**Computer architecture**  
**HW accelerator for deep learning (DL) workloads**  
**Mapping and dataflow optimization on accelerators**  
**Cross-stack optimization of AI systems**  
**Network-on-Chips (NoCs)**  
**Machine learning**

## Book

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Tushar Krishna, **Hyoukjun Kwon**, Angshuman Parashar, Michael Pellauer, and Ananda Samajdar (*alphabetical order*), “*Synthesis lecture on computer architecture: Data Orchestration in Deep Learning Accelerators* ([Link](#))”, Morgan & Claypool Publishers, August 2020

## Peer-reviewed Publications

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**Hyoukjun Kwon**, Krishnakumar Nair, Jinook Song, Colby Banbury, Mark Mazumder, Peter Capak, Yu-Hsin Chen, Liangzhen Lai, Tushar Krishna, Harshit Khaitan, Vikas Chandra, Vijay Janapa Reddi, “*MetaBench: Real-Time Multi-Modal Benchmark for Metaverse*”, *Third Workshop on Benchmarking Machine Learning Workloads on Emerging Hardware @ MLSys2022 (MLBench)*, 2022, **Received the best paper award**

Jiaqi Gu, **Hyoukjun Kwon**, Dilin Wang, Wei Ye, Meng Li, Yu-Hsin Chen, Liangzhen Lai, Vikas Chandra, and David Z. Pan, “*Multi-Scale High-Resolution Vision Transformer for Semantic Segmentation*”, *IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)*, 2022

Prasanth Chatarasi, **Hyoukjun Kwon**, Angshuman Parashar, Michael Pellauer, Tushar Krishna and Vivek Sarkar, “*Marvel: A Data-Centric Approach for Mapping Deep Learning Operators on Spatial Accelerators*”, *ACM Transactions on Architecture and Code Optimization (TACO)*, 2021

Gordon E Moon, **Hyoukjun Kwon**, Geonhwa Jeong, Prasanth Chatarasi, Sivasankaran Rajamanickam, Tushar Krishna, “*Evaluating Spatial Accelerator Architectures with Tiled Matrix-Matrix Multiplication*”, *IEEE Transactions on Parallel and Distributed Systems (TPDS)*, 2021

Eric Qin, Geonhwa Jeong, William Won, Sheng-Chun Kao, **Hyoukjun Kwon**, Sudarshan Srinivasan, Dipankar Das, Gordon E. Moon, Sivasankaran Rajamanickam, Tushar Krishna, “*Extending Sparse Tensor Accelerators to Support Multiple Compression Formats*”, *The 35th IEEE International Parallel & Distributed Processing Symposium (IPDPS)*, 2021

**Hyoukjun Kwon**, Liangzhen Lai, Michael Pellauer, Tushar Krishna, Yu-Hsin Chen, Vikas Chandra, “*Heterogeneous Dataflow Accelerators for Multi-DNN Workloads*”, *The 27th IEEE International Symposium on High-Performance Computer Architecture (HPCA)*, 2021

**Hyoukjun Kwon**, Michael Pellauer, Angshuman Parashar, Tushar Krishna, “*Flexion: A Quantitative Metric for Flexibility in DNN Accelerators*”, *IEEE Computer Architecture Letters (CAL)*, 2021

**Robert Guirado and Hyoukjun Kwon (equal contribution)**, Sergi Abadal, Eduard Alarcon, Tushar Krishna, “*Dataflow-Architecture Co-Design for 2.5D DNN Accelerators using Wireless Network-on-Package*”, *The 26th Asia and South Pacific Design Automation Conference (ASP-DAC)*, 2021

Jinwoo Kim, Gauthaman Murali, Heechun Park, Eric Qin, **Hyoukjun Kwon**, Venkata Chaitanya Krishna, Nihar Dasari, Arvind Singh, Minah Lee, Hakki Torun, Kallol Roy, Madhavan Swaminathan, Saibal Mukhopadhyay, Tushar Krishna, Sung Kyu Lim, “*Architecture, Chip, and Package Co-design Flow for 2.5D Integration of Reusable IP Chiplets*”, *IEEE Transactions on Very Large Scale Integration (VLSI) Systems (VLSI)*, 2020

Lei Yang, Zheyu Yan, Meng Li, **Hyoukjun Kwon**, Liangzhen Lai, Tushar Krishna, Vikas Chandra, Weiwen Jiang, Yiyu Shi, “*Co-Exploration of Neural Architectures and Heterogeneous ASIC Accelerator Designs Targeting Multiple Tasks*”, *The 57th Annual Design Automation Conference (DAC)*, 2020

**Hyoukjun Kwon**, Prasanth Chatarasi, Michael Pellauer, Angshuman Parashar, Vivek Sarkar, Tushar Krishna, “*MAESTRO: A Data-Centric Approach to Understand Reuse, Performance, and Hardware Cost of DNN Dataflows*”, *IEEE MICRO: Top-Picks in Computer Architecture Conferences in 2019 (Top-Picks)*, 2020

Eric Qin, Ananda Samajdar, **Hyoukjun Kwon**, Vineet Nadella, Sudarshan Srinivasan, Dipankar Das, Bharat Kaul, Tushar Krishna, “*SIGMA: A Sparse and Irregular GEMM Accelerator with Flexible Interconnects for DNN Training*”, *The 26th IEEE International Symposium on High-Performance Computer Architecture (HPCA)*, 2020  
**Received the best paper award**

Robert Guirado, **Hyoukjun Kwon**, Sergi Abadal, Eduard Alarcon, Tushar Krishna, “*Understanding the Impact of On-Chip Communication on DNN Accelerator Performance*”, *The 26th IEEE International Conference on Electronics Circuits and Systems (ICECS)*, 2019

**Hyoukjun Kwon**, Prasanth Chatarasi, Michael Pellauer, Angshuman Parashar, Vivek Sarkar, Tushar Krishna, “*Understanding Reuse, Performance, and Hardware Cost of DNN Dataflows: A Data-Centric Approach*”, *The 52nd IEEE/ACM International Symposium on Microarchitecture (MICRO)*, 2019  
**Selected as Top Picks in Computer Architecture Conferences in 2019**

Jinwoo Kim, Gauthaman Murali, Heechun Park, Eric Qin, **Hyoukjun Kwon**, Venkata Chaitanya Krishna, Nihar Dasari, Arvind Singh, Minah Lee, Hakki Torun, Kallol Roy, Madhavan Swaminathan, Saibal Mukhopadhyay, Tushar Krishna, Sung Kyu Lim, “*Architecture, Chip, and Package Co-design Flow for 2.5D Integration of Reusable IP Chiplets*”, *The 56th Design Automation Conference (DAC)*, 2019

Zhongyuan Zhao, **Hyoukjun Kwon**, Sachit Kuhar, Weiguang Sheng, Zhigang Mao, Tushar Krishna, “*mRNA: Enabling Efficient Mapping Space Exploration on a Reconfigurable Neural Accelerator*”, *The 20th IEEE International Symposium on Performance Analysis of Systems and Software (ISPASS)*, 2019

**Hyoukjun Kwon**, Ananda Smajdar, Tushar Krishna, “*A Communication-driven Approach for Designing Flexible DNN Accelerators*”, *IEEE Micro Special Issue on Hardware Acceleration (IEEE Micro)*, 2018

Brian Lebiednik, Sergi Abadal, **Hyoukjun Kwon**, Tushar Krishna, “*Architecting a Secure Wireless Network-on-*

Chip”, *The 12th IEEE/ACM International Symposium on Networks-on-Chip (NOCS)*, 2018

**Hyoukjun Kwon**, Ananda Samajdar, Tushar Krishna, “MAERI: Enabling Flexible Dataflow Mapping over DNN Accelerators via Reconfigurable Interconnects”, *The 23rd ACM International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS)*, 2018

**Honorable mention for Top Picks in Computer Architecture Conferences in 2018**

**Hyoukjun Kwon**, Ananda Samajdar, Tushar Krishna, “MAERI: Enabling Flexible Dataflow Mapping over DNN Accelerators via Reconfigurable Interconnects”, *The Inaugural Sysml Conference (Sysml)*, not archived, 2018

Brian Lebednik, Sergi Abadal, **Hyoukjun Kwon**, Tushar Krishna, “Spoofing Prevention via RF Power Profiling in Wireless Network-on-Chip”, *The 3rd International Workshop on Advanced Interconnect Solutions and Technologies for Emerging Computing Systems (AISTECS)*, 2018

**Hyoukjun Kwon**, Ananda Samajdar, Tushar Krishna, “Rethinking NoCs for Spatial Neural Network Accelerators”, *The 11th International Symposium on Networks-on-Chips (NOCS)*, 2017

Janardhan Rao Doppa, Ryan Gary Kim, Mihailo Isakov, Michel A. Kinsy, **Hyoukjun Kwon**, Tushar Krishna, “Adaptive Manycore Architectures for Big Data Computing”, *The 11th International Symposium on Networks-on-Chips (NOCS)*, 2017

**Hyoukjun Kwon**, William Harris, Hadi Esmaeilzadeh, “Proving Flow Security of Sequential Logic via Automatically Synthesized Relational Invariants”, *The 34th Computer Security Foundations (CSF)*, 2017

**Hyoukjun Kwon**, Tushar Krishna, “OpenSMART: Single-Cycle Multi-hop NoC Generator in BSV and Chisel”, *The 18th IEEE International Symposium on Performance Analysis of Systems and Software (ISPASS)*, 2017

**Hyoukjun Kwon**, Dohyun Kim, Jisung Park, Jihong Kim, “Improving the Lifetime of NAND Flash-based Storages Using MADE (Minhash-Assisted Delta-compression Engine)”, *Korean Institute of Information Science and Engineers Annual Conference (KIISE)*, 2014

## Invited Talks

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### Accelerator System Design Challenges from Real-time and Multi-DNN Workloads

IEEE International Conference on Artificial Intelligence Circuits and Systems - Tutorial

Jun. 2022

### Heterogeneous Dataflow Accelerators for AR/VR Workload

ACM SigArch Korea Workshop

Aug. 2021

### Understanding hardware-mapping-model co-design space for efficient deep learning inference

Seoul National University: AI Summer School 2021

Aug. 2021

## Understanding Reuse, Performance, and Hardware Cost of DNN Accelerator Dataflows

Pohang University of Science and Technology (Postech); Online Invited Talk – AI Seminar Series

Aug. 2020

## An Open Source Framework for Exploring Dataflow and Generating DNN Accelerators Supporting Flexible Dataflow

IBM Research, Yorktown Heights, New York

Nov. 2018

## Services

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### Architecture, Compiler, and System Support for Multi-model DNN Workloads Workshop

Workshop co-organizer (main PoC)  
([2021 at MICRO link](#)) , ([2022 at ISCA link](#))

2021 (MICRO), 2022 (ISCA)

### Program Committee (PC)

IEEE/ACM International Symposium on Computer Architecture (ISCA)

2023

### Technical Program Committee (TPC)

Design Automation Conference (DAC)

2023

### Technical Program Committee (TPC)

Design, Automation and Test in Europe Conference | The European Event for Electronic System Design & Test (DATE)

2023

### Program Committee (PC)

The ACM International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS)

2023 (Fall)

### External Review Committee (ERC)

IEEE International Symposium on High-Performance Computer Architecture (HPCA).

2023

### External Review Committee (ERC)

The ACM International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS)

2023 (Spring and Summer)

### External Review Committee (ERC)

Conference on Computer Vision and Pattern Recognition (CVPR)

2023

### Technical Program Committee (TPC)

The International Conference for High Performance Computing, Networking, Storage, and Analysis (SC)

2022

### Program Committee (PC)

IEEE International Symposium on Workload Characterization (IISWC)

2022

### **External Review Committee (ERC)**

IEEE/ACM International Symposium on Computer Architecture (ISCA)

2021, 2022

### **External Review Committee (ERC)**

IEEE/ACM International Symposium on Microarchitecture (MICRO)

2021, 2022

### **Journal Reviewer**

IEEE Computer Architecture Letters

2020, 2021

### **Journal Reviewer**

IEEE MICRO

2019, 2022

### **Journal Reviewer**

IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems

2021

### **Journal Reviewer**

ACM Transactions on Architecture and Code Optimization (TACO)

2019, 2020, 2021

### **Journal Reviewer**

IEEE Transactions on Emerging Topics in Computing

2022

### **Journal Reviewer**

IEEE Transactions on Computers (TOC)

2019, 2020, 2021, 2022

### **Journal Reviewer**

IEEE Journal on Emerging and Selected Topics in Circuits and Systems (JETCAS)

2020

### **Journal Reviewer**

IEEE Transactions on Neural Networks and Learning Systems (TNNLS)

2020

### **Journal Reviewer**

IEEE Open Journal of Circuits and Systems (CAS)

2020

## Skills and Experiences

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### Software languages

C/C++, Matlab, and Python

### Typesetting System

Latex

### Machine Learning Frameworks

PyTorch

### Formal verification tools

Coq Proof Assistant

### Hardware languages

Verilog and Bluespec System Verilog

### ASIC CAD tools

Synopsys Design Compiler and Cadence Encounter(Innovus)

### FPGA synthesis tools

Xilinx Vivado and Altera Quartus

### Parallel programming

OpenMP, OpenCL, and MPI

### Image processing

OpenCV and Matlab

### Languages

Korean (Native), English (Fluent), and Japanese (Proficient)