Ruokai Yin

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Research Interests

- Computer Architecture
  - → Accelerator Design
    - → Systolic-Array
    - → Sparse Tensor Accelerator
  - → Accelerator Simulation
- Neuromorphic Computing
  - → Spiking Neural Networks
- Stochastic Computing
  - → Unary Computing
- Efficient Machine Learning Co-Design
  - → Network Compression
    - → Quantization
    - → Pruning

Education

Ph.D. Candidate, Electrical Engineering, Yale University **Sep. 2021 — Current**
Advisor: Prof. Priyadarshini Panda

B.S., Electrical Engineering & Computer Science & Math, University of Wisconsin - Madison **Sep. 2018 — May. 2021**
Graduate with the highest honor, GPA: 3.98/4.00

Experience

Research Assistant, ICL Lab, advisor: Prof. Priyadarshini Panda **July. 2021 — Current**
- Computer architectures, systems, and algorithm co-design for neural network acceleration & neuromorphic computing.

Research Assistant, UW STACS Lab, advisor: Prof. Joshua San Miguel **June. 2019 — May. 2021**
- Computer architectures & systems for unary & stochastic computing.

Publications [Conference]

Neuromorphic Computing:

MINT: Multiplier-less Integer Quantization for Spiking Neural Networks.
Ruokai Yin, Yuhang Li, Abhishek Moitra, and Priyadarshini Panda
Asia and South Pacific Design Automation Conference (ASP-DAC) 2024, **Nomination of Best Paper (2% of submitted papers).**

TT-SNN: Tensor Train Decomposition for Efficient Spiking Neural Network Training.
Donghyun Li, **Ruokai Yin**, Youngeun Kim, Abhishek Moitra, Yuhang Li, and Priyadarshini Panda
Design Automation and Test in Europe (DATE) 2024.

Are SNNs Truly Energy-efficient? − A Hardware Perspective.
Abhiroop Bhattacharjee*, **Ruokai Yin***, Abhishek Moitra, and Priyadarshini Panda
IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP) 2024.

Wearable-based Human Activity Recognition with Spatio-Temporal Spiking Neural Networks.
Yuhang Li, **Ruokai Yin**, Hyoungseob Park, Youngeun Kim, and Priyadarshini Panda
Conference on Neural Information Processing Systems (NeurIPS) 2022 Workshop, **Spotlight Paper.**

Lottery Ticket Hypothesis for Spiking Neural Networks.
Youngeun Kim, Yuhang Li, Hyoungseob Park, Yeshwanth Venkatesha, **Ruokai Yin**, and Priyadarshini Panda
European Conference on Computer Vision (ECCV) 2022, **Oral Presentation (2.7% of submitted papers).**

Stochastic Computing:

UGEMM: Unary Computing Architecture for GEMM Applications.
Di Wu, Jingjie Li, **Ruokai Yin**, Hsuan Hsiao, Younghyun Kim, Joshua San Miguel
International Symposium on Computer Architecture (ISCA) 2020, **IEEE Top-pick 2020.**

Normalized stability: a cross-level design metric for early termination in stochastic computing.
Di Wu, **Ruokai Yin**, Joshua San Miguel
Asia and South Pacific Design Automation Conference (ASP-DAC) 2021

Publications [Journal]

Neuromorphic Computing:

Rethinking Skip Connections in Spiking Neural Networks with Time-To-First-Spike Coding.
Youngeun Kim, Adar Kahana, **Ruokai Yin**, Yuhang Li, Panos Stinis, George Em Karniadakis, Priyadarshini Panda
Frontiers in Neuroscience, 2024.

Efficient Human Activity Recognition with Spatio-Temporal Spiking Neural Networks.
Yuhang Li, **Ruokai Yin**, Youngeun Kim, and Priyadarshini Panda
Frontiers in Neuroscience, 2023.

Sharing Leaky-Integrate-and-Fire Neurons for Memory-Efficient Spiking Neural Networks.
Youngeun Kim, Yuhang Li, Abhishek Moitra, **Ruokai Yin**, and Priyadarshini Panda
Frontiers in Neuroscience, 2023.

SATA: Sparsity-Aware Training Accelerator for Spiking Neural Networks.
Ruokai Yin, Abhishek Moitra, Abhiroop Bhattacharjee, Youngeun Kim, and Priyadarshini Panda
IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems (TCAD), 2022.

Stochastic Computing:

uGEMM: Unary Computing for GEMM Applications.
Di Wu, Jingjie Li, **Ruokai Yin**, Hsuan Hsiao, Younghyun Kim, Joshua San Miguel
IEEE Micro, 2021.

In-Stream Correlation-Based Division and Bit-Inserting Square Root in Stochastic Computing.
Di Wu, **Ruokai Yin**, Joshua San Miguel
IEEE Design & Test, 2021.

Talks

MINT: Multiplier-less Integer Quantization for Energy Efficient Spiking Neural Networks
29th ASP-DAC (Incheon, South Korea), Jan 2024

SATA: Sparsity-Aware Training Accelerator for Spiking Neural Networks
Center for Brain-Inspired Computing (C-BRIC, SRC), Nov 2022

UnarySim and Characterizing Early Termination in Stochastic Computing
2020 UW Computer Architecture Industrial Affiliates (Madison, WI, USA), Sep 2020

Teaching Experience

TA - EENG 439, Neural Networks & Learning Systems, Fall 2023
Instructor: Prof. Priya Panda

TA - EENG 348, Digital Systems, Spring 2023
Instructor: Prof. Rajit Manohar

Awards & Honors

Academic

- **John Bennett Fenn Fellowship Fund,** Fall 2021 – Spring 2022 — Yale University
- **Dean's Honor List,** Fall 2018 – Spring 2021 — University of Wisconsin - Madison
- **China National Scholarship,** Fall 2016 – Spring 2017, (Highest scholarship, top 0.1%) — Southwest Jiaotong University

Research

- **Best Paper Award Nomination, Asia-South Pacific Design Automation Conference (ASP-DAC)**, 2023
- **Spotlight Paper, NeurIPS Workshop on Learning from Time Series for Health**, 2022
- **IEEE Micro Top Pick, Computer Architecture,** 2020

Academic Activities

Reviewer

- IEEE Transactions on Neural Networks and Learning Systems

- 2024 IEEE International Symposium on Circuits and Systems
- IEEE Journal on Emerging and Selected Topics in Circuits and Systems
- IEEE Transactions on Very Large Scale Integration Systems
- IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems
- AI Communications