HANQING ZHU

Graduate Research Assistant ◇ ECE Department ◇ University of Texas at Austin
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RESEARCH INTERESTS

- High-performance and reliable AI computing systems with emerging hardware (photonics, MRAM)
- Machine learning and its application in AI computing systems and design automation

EDUCATION

The University of Texas at Austin (UT-Austin), TX, USA *Aug. 2020 – - Present*
Ph.D. student, Department of Electrical and Computer Engineering
Advisor: David Z. Pan
Co-advisor: Ray T. Chen
(GPA: 3.95/4.00)

Shanghai Jiao Tong University (SJTU), Shanghai, China *Sept. 2016 - Jun. 2020*
B.E., Dept. of Microelectronics Science and Engineering
(GPA: 3.81/4.00)
(Rank: 2^{nd}/57)

PROFESSIONAL EXPERIENCE

Google LLC., CA, USA *Jul. 2022 – Nov. 2022*
Student Researcher, Google Brain

- Reinforcement Learning for VLSI Macro Placement

HONORS AND AWARDS

Winner at Robert S. Hilbert Memorial Optical Design Competition	Synopsys	2022
DAC Young Fellow	DAC	2021
Shanghai Outstanding Graduate	Shanghai City	2020
Departmental Excellent Undergraduate Thesis	Shanghai Jiao Tong University	2020
Hongyi Scholarship	Shanghai Jiao Tong University	2019
Outstanding Undergraduate Scholarship	Shanghai Jiao Tong University	2019
Samsung Scholarship	Shanghai Jiao Tong University	2018
Zhiyuan College Honors Scholarship	Shanghai Jiao Tong University	2018
1st Prize, National Mathematical Contest in Modeling	Shanghai Division	2018
Academic Excellence Scholarship	Shanghai Jiao Tong University	2017-2019

RESEARCH EXPERIENCE

The University of Texas at Austin, TX, USA *Aug. 2020 – Present*
Graduate Research Assistant, advised by Prof. David Z. Pan and Prof Ray T. Chen

- **ML for EDA**
  - Reinforcement learning for Macro placement : Intern project.
  - DREAMPlace quality improvement.
- **Emerging Hardware for Efficient AI Computing**
  - Contribute to the open-source library for photonic AI computing Torch-ONN.
  - Electronic-photonic NN accelerator. [C1, C5, C6, J1, J3, J4]
  - Photonic in-memory computing. [J2, C5]
- **Co-design for Efficient and Reliable Emerging Hardware**
  - Model-circuit co-optimization for efficiency enhancement. [C6, C9, J3]
  - Reliability-driven optimization
    - Aging-aware optimization for Photonic in-memory computing. [J2, C5]
    - Quantization and variation-aware training for robustness enhancement. [C1, C5, J2]
  - On-chip/on-device learning for self-learnable emerging AI hardware. [C4]

– Memory-efficient NN Design. [C3]

PROFESSIONAL SERVICE

Reviewer

- Nature Photonics (second reviewer)
- Photonic Network Communications
- IEEE Transactions on Neural Networks and Learning Systems (TNNLS)
- IEEE/ACM International Conference on Computer-Aided Design (ICCAD)
- IEEE International Conference on Artificial Intelligence Circuits and Systems (AICAS)

TEACHING & VOLUNTEER EXPERIENCES

Graduate Teaching Assistant

- EE316: Digital Logic Design — Fall 2022

Volunteer

- Conference Volunteer, the IEEE International Symposium on Circuits and Systems (ISCAS) — 2022
- Volunteer Teacher, Eryuan No.2 high school, Yunnan, China — Aug. 2017- Sept. 2017
  - Awarded with "Color for love" bronze prize of Chinese college students' rural supporting education

RELATED COURSES

- EE381V: Combinatorial Optimization — *Prof. Constantine Caramanis*
- EE382M: VLSI CAD and Optimization — *Prof. David Z. Pan*
- EE382N: Computer Architecture: Parallelism/Locality — *Prof. Mattan Erez*
- EE381V: Advanced Topics in Computer Vision — *Prof. Zhangyang (Atlas) Wang*
- EE381K: Convex Optimization — *Prof. Constantine Caramanis*
- EE382M: VLSI I — *Prof. David Z. Pan*
- EE382M: VLSI Physical Design Automation — *Prof. David Z. Pan*
- EE382V: Cross-layer Machine Learning Algorithm/Hardware Co-design — *Prof. Mattan Erez and Prof. Michael Orshansky*

SKILLS

Programming Languages
Python (PyTorch), C++, CUDA, Verilog

EDA Tools
Cadence Virtuoso, Synopsys Design Compiler, Hspice, Xilinx Vivado Design Suite, Synopsys Optodesigner

PUBLICATIONS

Journal Papers

[J4] Chenghao Feng*, Jiaqi Gu*, **Hanqing Zhu**, Zhoufeng Ying, Zheng Zhao, David Z. Pan , and Ray T. Chen, "A compact butterfly-style silicon photonic-electronic neural chip for hardware-efficient deep learning," in *ACS Photonics*, 2022..

[J3] Jiaqi Gu, Chenghao Feng, **Hanqing Zhu**, Zheng Zhao, Zhoufeng Ying, Mingjie Liu, Ray T. Chen and David Z. Pan, "SqueezeLight: A Multi-Operand Ring-Based Optical Neural Network with Cross-Layer Scalability," in *IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems (TCAD)*, Jul., 2022.

[J2] **Hanqing Zhu**, Jiaqi Gu, Chenghao Feng, Mingjie Liu, Zixuan Jiang, Ray T. Chen, and David Z. Pan, "ELight: Towards Efficient and Aging-Resilient Photonic In-Memory Neurocomputing," in *IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems (TCAD)*, Jun., 2022.

[J1] Jiaqi Gu, Chenghao Feng, **Hanqing Zhu**, Ray T. Chen and David Z. Pan, "Light in AI: Toward Efficient Neurocomputing with Optical Neural Networks - A Tutorial," in *IEEE Transactions on Circuits and Systems–II: Express Briefs (TCAS-II)*, Apr., 2022.

Conference Papers

[C11] Jiaqi Gu, Zhengqi Gao, Chenghao Feng, **Hanqing Zhu**, Ray Chen, Duane S Boning, and David Z. Pan, " NeurOLight: A Physics-Agnostic Neural Operator Enabling Parametric Photonic Device Simulation," in *Conference on Neural Information Processing Systems (NeurIPS)*, Nov 26 - Dec 4, 2022. (Accepted)

[C10] Harrison Jin, **Hanqing Zhu**, Keren Zhu, Thomas Leonard, Mahshid Alamdar, David Z. Pan, and Jean Anne C. Incorvia, "Design of Domain Wall-Magnetic Tunnel Junction Analog Content Addressable Memory using Current and Projected Prototype Data," in *Annual Conference on Magnetism and Magnetic Materials (MMM)*, Minneapolis, MN, October 31 - November 4, 2022. (Accepted)

[C9] **Hanqing Zhu**, Keren Zhu, Jiaqi Gu, Harrison Jin, Ray Chen, Jean Anne Incorvia and David Z. Pan, "Fuse and Mix: MACAM-Enabled Analog Activation for Energy-Efficient Neural Acceleration" in *IEEE/ACM International Conference on Computer-Aided Design (ICCAD)*, Oct., 2022

[C8] Chenghao Feng, Jiaqi Gu, **Hanqing Zhu**, Zhoufeng Ying, Zheng Zhao, David Z. Pan, and Ray T. Chen, "Optoelectronically Interconnected Hardware-Efficient Deep Learning using Silicon Photonic Chips," in *Smart Photonic and Optoelectronic Integrated Circuits (SPIE)*, Mar., 2022

[C7] Chenghao Feng, Jiaqi Gu, **Hanqing Zhu**, David Z. Pan, and Ray T. Chen, "Design and Experimental Demonstration of A Hardware-Efficient Integrated Optical Neural Network," in *Smart Photonic and Optoelectronic Integrated Circuits (SPIE)*, Mar., 2022

[C6] Jiaqi Gu, **Hanqing Zhu**, Chenghao Feng, Zixuan Jiang, Mingjie Liu, Shuhan Zhang, Ray T. Chen, and David Z. Pan, "ADEPT: Automatic Differentiable DEsign of Photonic Tensor Cores," in *ACM/IEEE Design Automation Conference (DAC)*, Jul., 2022

[C5] **Hanqing Zhu**, Jiaqi Gu, Chenghao Feng, Mingjie Liu, Zixuan Jiang, Ray T. Chen, and David Z. Pan, "ELight: Enabling Efficient Photonic In-Memory Neurocomputing with Life Enhancement," in *IEEE/ACM Asia and South Pacific Design Automation Conference (ASP-DAC)*, Jan., 2022.

[C4] Jiaqi Gu, **Hanqing Zhu**, Chenghao Feng, Zixuan Jiang, Ray T. Chen, and David Z. Pan, "L2ight: Enabling On-Chip Learning for Optical Neural Networks via Efficient in-situ Subspace Optimization," in *Conference on Neural Information Processing Systems (NeurIPS)*, Dec., 2021.

[C3] Jiaqi Gu, **Hanqing Zhu**, Chenghao Feng, Mingjie Liu, Zixuan Jiang, Ray T. Chen, and David Z. Pan, "Towards Memory-Efficient Neural Networks via Multi-Level in situ Generation," in *International Conference on Computer Vision (ICCV)*, Oct., 2021.

[C2] Chenghao Feng, Jiaqi Gu, **Hanqing Zhu**, David Z. Pan, and Ray T. Chen, "Experimental Demonstration of a WDM-based Integrated Optical Decoder for Compact Optical Computing," in *Conference on Lasers and Electro-Optics*, May, 2021.

[C1] Jiaqi Gu, Zheng Zhao, Chenghao Feng, **Hanqing Zhu**, Ray T. Chen, and David Z. Pan, "ROQ: A Noise-Aware Quantization Scheme Towards Robust Optical Neural Networks with Low-bit Controls," in *IEEE Design, Automation & Test in Europe Conference & Exhibition (DATE)*, Mar., 2020.