

Hanrui Wang

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RESEARCH INTERESTS

Quantum computer architecture and systems; Machine learning algorithm-hardware co-design; ML for systems; Hybrid Quantum-Classical computing

EDUCATION

Massachusetts Institute of Technology, Cambridge, MA, US 2018.09 - present
Ph.D. Student in Department of Electrical Engineering and Computer Science GPA: **5/5**
Advisor: Professor Song Han

Massachusetts Institute of Technology, Cambridge, MA, US 2018.09 - 2020.05
M.S. in Electrical Engineering and Computer Science GPA: **5/5**

The University of Chicago, IL, US 2022.06 - 2022.09
Visiting scholar advised by Professor Fred Chong, CS Department

Fudan University, Shanghai, China 2014.09 - 2018.07
B.Eng. (Honours) in Electrical Engineering GPA: **3.91/4**(1st/256)
School of Information Science & Technology, School of Microelectronics

University of California, Los Angeles, LA, US 2017.06 - 2017.10
Visiting scholar advised by Professor Jason Cong, CS Department GPA: **4/4**(1st/94)

PUBLICATIONS

Refereed Conference Papers

- HPCA'22 **Hanrui Wang**, Yongshan Ding, Jiaqi Gu, Yujun Lin, Zirui Li, David Z. Pan, Frederic T. Chong, Song Han, "QuantumNAS: Noise-Adaptive Search for Robust Quantum Circuits," *HPCA, 2022, NSF AI Institute Best Poster Award; 1st Place Award, ACM Student Research Competition*
- HPCA'21 **Hanrui Wang**, Zhekai Zhang, Song Han, "SpAtten: Efficient Sparse Attention Architecture with Cascade Token and Head Pruning," *HPCA 2021, DAC 2023 Best Demo Award; MIT Homepage Spotlight*.
- HPCA'20 **Hanrui Wang***, Zhekai Zhang*, Song Han, William J. Dally, "SpArch: Efficient Architecture for Sparse Matrix Multiplication," *HPCA 2020. (*equal contribution)*
- DAC'20 **Hanrui Wang**, Jiaqi Gu, Yongshan Ding, Zirui Li, Frederic T. Chong, David Z. Pan, Song Han, "QuantumNAT: Quantum Noise-Aware Training with Noise Injection, Quantization and Normalization," *DAC 2022*.
- ICCAD'22 **Hanrui Wang**, Pengyu Liu, Jinglei Cheng, Zhiding Liang, Jiaqi Gu, Zirui Li, Yongshan Ding, Weiwen Jiang, Yiyu Shi, Xuehai Qian, David Z. Pan, Frederic T. Chong, Song Han, "QuEst: Graph Transformer for Quantum Circuit Reliability Prediction," *ICCAD, 2022*.
- DAC'22 **Hanrui Wang**, Zirui Li, Jiaqi Gu, Yongshan Ding, David Z. Pan, Song Han, "QOC: Quantum On-Chip Training with Parameter Shift and Gradient Pruning," *DAC 2022, Best Presentation Award, MIT MTL Annual Research Conference*
- QCE'22 Zhiding Liang*, **Hanrui Wang***, Jinglei Cheng, Yongshan Ding, Hang Ren, Xuehai Qian, Song Han, Weiwen Jiang, Yiyu Shi "Variational quantum pulse learning", *QCE, 2022*
- ACL'20 **Hanrui Wang**, Zhanghao Wu, Zhijian Liu, Han Cai, Ligeng Zhu, Chuang Gan, Song Han, "HAT: Hardware-Aware Transformers for Efficient Natural Language Processing," *ACL 2020*.
- DAC'20 **Hanrui Wang**, Kuan Wang, Jiacheng Yang, Linxiao Shen, Nan Sun, Hae-Seung Lee, Song Han, "GCN-RL Circuit Designer: Transferable Transistor Sizing with Graph Neural Networks and Reinforcement Learning," *DAC 2020, Best Presentation Award*.

- ISLPED'20 Zexi Ji*, **Hanrui Wang***, Miaorong Wang, Win-San Khwa, Meng-Fan Chang, Song Han and Anantha P. Chandrakasan, "A Fully-Integrated Energy-Scalable Transformer Accelerator Supporting Adaptive Model Configuration and Word Elimination for Language Understanding on Edge Devices," *ISLPED 2023*.
- CHIL'23 Jessica Zheng*, **Hanrui Wang***, Anand Chandrasekhar, Joohyun Seo, Aaron Aguirre, song han, Hae Lee, Charlie Sodini, "Machine Learning for Arterial Blood Pressure Prediction," *CHIL 2023*.
- VLSI'22 Ruicong Chen, **Hanrui Wang**, Anantha Chandrakasan, Hae-Seung Lee, "RaM-SAR: A Low Energy and Area Overhead, 11.3 fJ/conv.-step 12b 25MS/s Secure Random-Mapping SAR ADC with Power and EM Side-channel Attack Resilience", *VLSI 2022*.
- HPCA'24 Hanqing Zhu, Jiaqi Gu, **Hanrui Wang**, Zixuan Jiang, Zhekai Zhang, Rongxing Tang, Chenghao Feng, Song Han, Ray T. Chen, David Z. Pan, "DOTA: A Dynamically-Operated Photonic Tensor Core for Energy-Efficient Transformer Accelerator," *HPCA 2024*.
- MICRO'21 Yujun Lin, Zhekai Zhang, Haotian Tang, **Hanrui Wang**, Song Han, "PointAcc: Efficient Point Cloud Accelerator," *MICRO 2021*.
- NeurIPS'19 Hongzi Mao, Parimarjan Negi, Akshay Narayan, **Hanrui Wang**, *et al*, "Park: An Open Platform for Learning-Augmented Computer Systems," *NeurIPS 2019, ICML RL4RL Workshop 2019 Best Paper Award*.
- FCCM'18 Jason Cong*, Zhenman Fang*, Michael Lo*, **Hanrui Wang***, Jingxian Xu*, Shaochong Zhang*, **(*Alphabetical)**, "Understanding Performance Differences of FPGAs and GPUs," *FCCM 2018*.
- ECCV'18 Yihui He*, Ji Lin*, Zhijian Liu, **Hanrui Wang**, Li-Jia Li, Song Han, "AMC: AutoML for Model Compression and Acceleration on Mobile Devices," *ECCV 2018*.
- CVPR'20 Tianzhe Wang, Kuan Wang, Han Cai, Ji Lin, Zhijian Liu, **Hanrui Wang**, Yujun Lin, Song Han, "APQ: Joint Search for Network Architecture, Pruning and Quantization Policy," *CVPR 2020*.
- ECCV'20 Haotian Tang, Zhijian Liu, Shengyu Zhao, Yujun Lin, Ji Lin, **Hanrui Wang**, Song Han, "Searching Efficient 3D Architectures with Sparse Point-Voxel Convolution," *ECCV 2020*.
- BCB'22 Zongxing Xie, **Hanrui Wang**, Song Han, Elinor Schoenfeld, Fan Ye, "DeepVS: A deep learning approach for RF-based vital signs sensing," *ACM BCB 2022*.
- QCE'23 Han Zheng, Christopher Kang, Gokul Subramanian Ravi, **Hanrui Wang**, Kanav Setia, Frederic T Chong, Junyu Liu, "SnCQA: A hardware-efficient equivariant quantum convolutional circuit architecture," *QCE 2023, Best Paper Award*.
- DAC'23 Zhiding Liang, Zhixin Song, Jinglei Cheng, Zichang He, Ji Liu, **Hanrui Wang**, Ruiyang Qin et al. "Hybrid gate-pulse model for variational quantum algorithms," *DAC 2023*.
- QCE'23 Tianlong Chen, Zhenyu Zhang, **Hanrui Wang**, Jiaqi Gu, Zirui Li, David Z. Pan, Frederic Chong, Song Han, Zhangyang Wang, "QuantumSEA: In-Time Sparse Exploration for Noise Adaptive Quantum Circuits," *QCE 2023*.
- QCE'23 Junyao Zhang, **Hanrui Wang**, Gokul Subramanian Ravi, Frederic T. Chong, Song Han, Frank Mueller, Yiran Chen, "DISQ: Dynamic Iteration Skipping for Variational Quantum Algorithms," *QCE 2023*.
- QSEEC'23 Zhiding Liang, **Hanrui Wang**, "QuCS: A lecture series on quantum computer software and system," *QSEEC 2023*

Refereed Journal Papers

- JMLR'20 Zhongxia Yan, **Hanrui Wang**, Demi guo, Song Han, "MicroNet for Efficient Language Modeling," *JMLR 2020, Champion of NeurIPS 2019 MicroNet Competition*.
- TODAES'21 Han Cai*, Ji Lin*, Yujun Lin*, Zhijian Liu*, Haotian Tang*, **Hanrui Wang***, Ligeng Zhu*, Song Han, **(*Alphabetical)** "Enable Deep Learning on Mobile Devices: Methods, Systems, and Applications", *ACM Transactions on Design Automation of Electronic Systems 2021*.

Refereed Workshop Papers

- ICCAD'23 **Hanrui Wang**, Yilian Liu, Pengyu Liu, Song Han, "ResilienQ: Boosting Fidelity of Quantum State Preparation via Noise-Aware Variational Training," *ICCAD FastML Workshop 2023*
- ICCAD'23 **Hanrui Wang**, Kevin Shao, Dantong Li, Jiaqi Gu, David Pan, Yongshan Ding, Song Han, "Transformer-QEC: Transferable Transformer for Quantum Error Correction Code Decoding," *ICCAD FastML Workshop 2023*
- NeurIPS'18 **Hanrui Wang**, Jiacheng Yang, Hae-Seung Lee, Song Han, "Learning to Design Circuits," *NeurIPS Workshop on ML for Systems 2018*

MLCAD'20 Wei Shi*, **Hanrui Wang***, Jiaqi Gu, Mingjie Liu, David Z. Pan, song han, Nan Sun, "RobustAnalog: Variation-Aware Optimization for Robust Analog Design with Multi-Task RL," *MLCAD 2022*. (***equal contribution**)

In Submission

1. Jinglei Cheng, **Hanrui Wang**, Zhiding Liang, Yiyu Shi, Song Han, Xuehai Qian, "TopGen: Topology-Aware Bottom-Up Generator for Variational Quantum Circuits," *arXiv 2210.08190*.
2. Zhiding Liang, Jinglei Cheng, Hang Ren, **Hanrui Wang**, Fei Hua, Yongshan Ding, Fred Chong, Song Han, Yiyu Shi, Xuehai Qian, "Pan: Pulse ansatz on nisq machines," *arXiv 2208.01215*.

WORKING EXPERIENCES

Nvidia Research, MA, US 2020.06 - 2020.08

Mentor: Mike O'Connor, Donghyuk Lee, Joel Emer. Manager: Steve Keckler

- Worked on efficient sparse matrix computations in Architecture Research Group.

Xilinx, Beijing, China 2018.07 - 2018.08

Mentor: Shuang Liang, Junbin Wang. Manager: Shaoxia Fang

- Worked on machine learning hardware accelerators.

TEACHING EXPERIENCES

- 2023 Organizer and Instructor, ISCA Tutorial on "TorchQuantum: A Fast Library for Parameterized Quantum Circuits"
- 2022 Co-Instructor and Course Developer, MIT new course, 6.S965 "TinyML and Efficient Deep Learning", 2022
- 2022 Guest Instructor, MIT 6.812/6.825 "Hardware Architecture for Deep Learning" on "Machine Learning Training", 2022
- 2022 Organizer and Instructor, ICCAD Tutorial on "TorchQuantum Case Study for Robust Quantum Circuits", 2022
- 2022 Organizer and Instructor, QCE Tutorial on "TorchQuantum: A Fast Library for Parameterized Quantum Circuits", 2022
- 2022-23 Organizer of "Quantum Computer Systems Lecture Series" episode 1 to 35
- 2020 Teaching Assistant, MIT 6.812/6.825 "Hardware Architecture for Deep Learning", 2020
- 2020 Grader, MIT 6.004 "Computation Structures", 2020
- 2018 Teaching Assistant, Fudan University, "Game Theory", 2018

AWARDS

- 2023 **Best Paper Award** at IEEE QCE 2023
- 2023 **Best Demo Award** at DAC University Demo 2023
- 2023 **PhD Forum** Attendee at MICRO 2023
- 2023 **PhD Forum** Attendee at DAC 2023
- 2023 **Rising Star** in Machine Learning and Systems
- 2023 **Best Poster Award** at Athena AI Institute
- 2023 **Best Presentation Award** in MIT MTL Annual Research Conference
- 2022 **1st Place** in ACM Student Research Competition SRC
- 2022 **1st/150 Place** in ACM/IEEE TinyML Design Contest, Flash Occupation Track
- 2022 NSF AI Institute **Best Poster Award rank #1**
- 2021 **Qualcomm Innovation Fellowship**
- 2021 **Analog Devices Outstanding Student Designer Award**
- 2021 **MIT Homepage Spotlight**
- 2021 **Baidu Fellowship**
- 2021 **Global Rising Stars in AI**
- 2020 **Nvidia Graduate Fellowship Finalist**
- 2020 **DAC Best Video Presentation Award**

2020 **DAC Fellowship**
2019 **Best Paper Award** of ICML Workshops
2019 **Champion** of NeurIPS 2019 MicroNet Efficient NLP Competition
2018 **Bronze Medal** in TensorFlow Speech Recognition Challenge
2017 **Cross-Disciplinary Scholars in Science & Technology (CSST) Research Fellowship**
2017 **CSST Best Research Award**
2016 **Chun-Tsung Research Fellowship** (launched by 1957 Physics Nobel laureate, Tsung-Dao Lee)
2017/16/15 **National Scholarship** (Highest honor for undergraduate academic and research excellence)

SERVICE

Journal Review	TCAS-II, JMLR, TNNLS, TODAES, T-ASE, Pattern Recognition, IJCV, TMLR, TQC, MLR, JOSS, AI Review, Applied Science, Sustainability, Electronics, NCIT, Bioinformation
Conference Review	NeurIPS, ICLR, EMNLP, ACL, ARR, MLSys, ICCAD, ICITED, ADVCOMP, FUZZ, IJCNN, CEC, WCCI, ICECCME, ICECET
Others	MLSys ERC Member, SOFC Web Chair, ICCAD TPC Member

OPEN-SOURCE SOFTWARE

[TorchQuantum](#), 1000+ Stars; [Hardware Aware Transformer](#), 300+ Stars; [Automatic Model Compression](#), 500+ Stars; [Park Computer System Task Set](#), 200+ Stars