Zhiding Liang

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222 Cushing Hall of Engineering, Notre Dame, IN, 46556

Education

Doctor of Philosophy | ***Computer Science and Engineering*** — Jul. 2021 – Present
University of Notre Dame, Advisor: Prof. Yiyu Shi — South Bend, IN, USA

Visiting PhD Student | ***Computer Science*** — Feb. 2023 – June. 2023
Yale University, Advisor: Prof. Yongshan Ding — New Haven, CT, USA

Bachelor of Science | ***Electrical and Computer Engineering*** — Aug. 2018 – Dec. 2020
University of Wisconsin - Madison, Advisor: Prof. Jude Shohet — Madison, WI, USA

Bachelor of Science | ***Computer Engineering*** — Aug. 2016 – May. 2018
Auburn University, Transferred — Auburn, AL, USA

Research Interest

- Varational Quantum Algorithms
- Quantum Pulse Control
- Quantum Machine Learning and Machine Learning for Quantum
- Hardware/Software Co-design for Quantum Computing

Honors and Awards

Edison Innovation Fellowship — 2023
IDEA Center at the University of Notre Dame

ICCAD Student Scholar with Progam Grant — 2023
International Conference on Computer-Aided Design (ICCAD)

Student Travel Award — 2023
International Symposium on Computer Architecture (ISCA)

DAC Young Fellow with Travel Grant — 2022
IEEE/ACM Design Automation Conference (DAC)

DAC Young Fellow — 2021
IEEE/ACM Design Automation Conference (DAC)

Certificate of Quantum Excellence — 2021
IBM

Dean's List — 2018 Fall - 2020 Fall
University of Wisconsin - Madison

Dean's Honor List 2017 Spring - 2018 Spring
Auburn University

PUBLICATIONS

Conference

[1] QuCS: A Lecture Series on Quantum Computer Software and System
Zhiding Liang, Hanrui Wang
Quantum Science and Engineering Education Conference and IEEE International Conference on Quantum Computing and Engineering (QCE), 2023
URL: https://qce.quantum.ieee.org/2023/

[2] Hybrid Gate-Pulse Model for Variational Quantum Algorithms
Zhiding Liang, Zhixin Song, Jinglei Cheng, Zichang He, Ji Liu, Hanrui Wang, Ruiyang Qin, Yiru Wang, Song Han, Xuehai Qian, Yiyu Shi
IEEE/ACM Design Automation Conference (DAC), 2023
URL: https://www.dac.com/

[3] Variational Quantum Pulse Learning
Zhiding Liang*, Hanrui Wang*, Jinglei Cheng, Yongshan Ding, Hang Ren, Zhengqi Gao, Duane Boning, Xuehai Qian, Song Han, Weiwen Jiang, Yiyu Shi
IEEE International Conference on Quantum Computing and Engineering (QCE), 2022
URL: https://qce.quantum.ieee.org/2023/

[4] TorchQuantum Case Study for Robust Quantum Circuits
Hanrui Wang, **Zhiding Liang**, Jiaqi Gu, Zirui Li, Yongshan Ding, Weiwen Jiang, Yiyu Shi, Xuehai Qian, David Z. Pan, Frederic T. Chong, Song Han
IEEE/ACM International Conference on Computer-Aided Design (ICCAD), 2022
URL: https://2023.iccad.com/

[5] Can Noise on Qubits Be Learned in Quantum Neural Network? A Case Study on QuantumFlow
Zhiding Liang, Zhepeng Wang, Junhuan Yang, Lei Yang, Yiyu Shi, Weiwen Jiang
IEEE/ACM International Conference on Computer-Aided Design (ICCAD), 2021
URL: https://2023.iccad.com/

[6] Exploration of Quantum Neural Architecture by Mixing Quantum Neuron Designs
Zhepeng Wang, **Zhiding Liang**, Shanglin Zhou, Caiwen Ding, Yiyu Shi, Weiwen Jiang
IEEE/ACM International Conference on Computer-Aided Design (ICCAD), 2021
URL: https://2023.iccad.com/

[7] A comprehensive understanding of conductive mechanism of RRAM: from electron conduction to ionic dynamics
Zhiding Liang
International Conference on Electrical Engineering and Control Technologies (CEECT), 2020
URL: https://www.ceect.org/

Journal

[1] NAPA: Intermediate-level Variational Native-pulse Ansatz for Variational Quantum Algorithms [highlighted by IBM Qiskit]
Zhiding Liang, Jinglei Cheng, Hang Ren, Hanrui Wang, Fei Hua, Yongshan Ding, Fred Chong, Song Han, Xuehai Qian, Yiyu Shi

IEEE Transactions on Computer-Aided Design of Integrated Circuits and Systems (TCAD) (2024)
URL: https://medium.com/qiskit/enhance-variational-quantum-algorithms-with-qiskit-pulse-and-qiskit-dynamics-768249daf8dd

[2] VIOLET: Visual Analytics for Explainable Quantum Neural Networks
Shaolun Ruan, **Zhiding Liang**, Qiang Guan, Paul Griffin, Xiaolin Wen, Yanna Lin, Yong Wang
IEEE Transactions on Visualization and Computer Graphics (TVCG) (2023)
URL: https://www.computer.org/csdl/journal/tg

In Submission

[1] Synergizing Quantum Techniques with Machine Learning: The Drug Discovery Challenge [Under Review]
Zhiding Liang, Zichang He, Yue Sun, Dylan Herman, Xiaowei Xu, Weiwen Jiang, Di Wu, Marco Pistoia, Yiyu Shi
Nature Machine Intelligence (NMI) (2023)
URL: https://www.nature.com/natmachintell/

[2] Quantum Optimization Algorithms for Islanding Problem in Power Systems
Yuqi Jiang, **Zhiding Liang**, Yiru Wang, Yan Li
[Abstract Accept for the Special Issue and Full Paper Under Review]
Informs Journal on Computing (2024)
URL: https://pubsonline.informs.org/doi/full/10.1287/ijoc.2023.cfp.v35.n3

[3] TopGen: Topology-Aware Bottom-Up Generator for Variational Quantum Circuits[Under Review]
Jinglei Cheng, Hanrui Wang, **Zhiding Liang**, Yiyu Shi, Song Han, Xuehai Qian
IEEE Transactions on Computers (2023)
URL: https://www.computer.org/csdl/journal/tc

[4] Universal Approximability of Deep Learning in Hybrid Quantum-Classical Computing
Weiwen Jiang, **Zhiding Liang**, Yukun Ding, Zhepeng Wang, Lei Yang, Yiyu Shi [Under Review]
Journal of Machine Learning Research (2022)
URL: https://www.jmlr.org/

Pre-Print

[1] SpacePulse: Combining Parameterized Quantum Pulses with Contextual Subspace for More Practical VQE
Zhiding Liang, Zhixin Song, Jinglei Cheng, Hang Ren, Tianyi Hao, Rui Yang, Yiyu Shi, Tongyang Li
arXiv Pre-print (2023)

[2] Unleashing the Potential of LLMs for Quantum Computing: A Study in Quantum Architecture Design
Zhiding Liang, Jinglei Cheng, Rui Yang, Hang Ren, Zhixin Song, Di Wu, Xuehai Qian, Tongyang Li, Yiyu Shi
arXiv Pre-print (2023)

[3] Fidelity estimator, randomized benchmarking and ZNE for quantum pulses
Jinglei Cheng, **Zhiding Liang**, Rui Yang, Yiyu Shi, Tongyang Li, Xuehai Qian
arXiv Pre-print (2023)

[4] Towards Advantages of Parameterized Quantum Pulses
Zhiding Liang, Zhixin Song Jinglei Cheng, Hang Ren, Rui Yang, Hanrui Wang, Kecheng Liu, Peter Kogge, Tongyang Li, Yongshan Ding, Yiyu Shi
arXiv Pre-print (2023)

[5] Improving Quantum Classifier Performance in NISQ Computers by Voting Strategy from Ensemble Learning
Ruiyang Qin, **Zhiding Liang**, Jinglei Cheng, Peter Kogge, Yiyu Shi
arXiv Pre-print (2022)

PROFESSIONAL EXPERIENCE

FinQ Tech Feb 2023 - now
https://finq.tech/

- Take the role of the seminar pillar at FinQ Tech. FinQ Tech is one of the largest quantum technology focused communities in the US with a global footprint. Our members are from various quantum technology companies, top universities, and research institutions. 50% of them are PhDs and postdocs in quantum-related fields.
- As a 501(c)(3) non-profit organization, we aim to provide a top learning environment and academia-industry connection for our members. Also, lead the efforts of creating quantum education material and developing practical quantum-enabled applications.

Quantum Computer Systems (QuCS) Lecture Series July 2022 - now
https://sites.nd.edu/quantum/

- Lead to organize QuCS, which is a Quantum computer systems lecture series from introduction session to research topic session co-organized by Hanrui Wang. Currently have 2500+ subscribers and over 50 confirmed speakers from over 30 institutions including both industry and academia of 8 different countries.
- Provide a great platform for people who are interested in quantum computing to learn the concepts of quantum computing and continue the discussion of cutting-edge research topics.

Torchquantum Library Feb 2022 - now
torchquantum.org

- One of the core members of the Torchquantum development team, majorly contributes to pulse support of Torchquantum. A PyTorch-based library for Quantum Simulation, Quantum Machine Learning, Quantum Neural Networks, and Parameterized Quantum Circuits with support for easy deployments on real quantum computers, over 1000 stars on GitHub, and over ten research manuscripts are using the Torchquntum.

2023 Quantum Computing for Drug Discovery Challenge at ICCAD Aug. 2023 - Oct. 2023
42nd IEEE/ACM International Conference on Computer-Aided Design (ICCAD) San Francisco, CA, USA

- Lead to organize the ACM/IEEE Quantum Computing for Drug Discovery Challenge at ICCAD. It is a challenging, multi-month, research and development competition, focusing on drug discovery-related problems that require the implementation of quantum algorithms. It is open to multi-person teams world-wide.

Parameterized Quantum Pulses and It's Application Sep. 2023
IEEE International Conference on Quantum Computing and Engineering Seattle, WA, USA

- Lead to organize the quantum computing tutorial session about the parameterized quantum pulses at QCE 2023 and gave a tutorial talk as an instructor.

TorchQuantum: A Fast Library for Parameterized Quantum Circuits June. 2023
50th International Symposium on Computer Architecture (ISCA) Orlando, FL, USA

- Co-organized the quantum computing tutorial session about the TorchQuantum library at ISCA 2023 and gave a tutorial talk as an instructor.

Tutorial: TorchQuantum Case Study For Robust Quantum Circuits Nov. 2022
41st IEEE/ACM International Conference on Computer-Aided Design (ICCAD) San Diego, CA, USA

- Co-organized the quantum computing tutorial session about the TorchQuantum library at ICCAD 2023 and gave a tutorial talk as an instructor.

TorchQuantum: A Fast Library for Parameterized Quantum Circuits Sep. 2022
IEEE International Conference on Quantum Computing and Engineering Broomfield, CO, USA

- Co-organized the quantum computing tutorial session about the TorchQuantum library at QCE 2023 and gave a tutorial talk as an instructor.

INVITED TALKS

Parameterized Quantum Pulses for Variational Quantum Algorithms Nov. 2023
Eitech Remote

Parameterized Quantum Pulses for Variational Quantum Algorithms Nov. 2023
University of Michigan-Shanghai Jiao Tong University Joint Institute Remote

Parameterized Quantum Pulses for Variational Quantum Algorithms Sep. 2023
MAIB by Society of Artificial Intelligence Research (SAIR) Remote

Hybrid Gate - Pulse Model for Variational Quantum Algorithm April. 2023
QUARK Lab at Peking University Remote

Scalable Design-Program-Compilation Optimizations for Quantum Algorithms July.2022
59th ACM/IEEE Design Automation Conference (DAC) San Francisco, CA

A Quantum Machine Learning Co-Design Framework Towards Quantum Advantage Nov. 2021
40th IEEE/ACM International Conference on Computer-Aided Design (ICCAD) Remote

Turtorial on Quantumflow Nov. 2021
Embedded Systems Week (ESWEEK), 2021 Remote

EMPLOYMENT

Research Assistant Jul. 2021 – Now
Department of Computer Science and Engineering, University of Notre Dame South Bend, IN, USA

Quantum Computing Research Technology Associate Intern June 2023 – Aug. 2023
JPMorgan Chase & Co New York, NY, USA

Research Assistant Feb 2023 – June. 2023
Department of Computer Science at Yale University New Haven, CT, USA

Research Assistant Sep. 2019 – Jan. 2020
Plasma Processing & Technology lab at UW-Madison Madison, WI, USA

Backend Developer Intern July. 2018 – Aug. 2018
Silan Microelectronics Co., Ltd Hangzhou, China

Teaching and Mentoring

Teaching Assistant

CSE 34341 Operating Systems Principles, University of Notre Dame Spring 2022

CSE 20289 Systems Programming, University of Notre Dame Fall 2021

Guest Lecturer

ECE6210 Machine Intelligence, George Washington University Nov. 2023

Professional Service

Committee Member

Quantum Science and Engineering Education Conference (QSEEC) 2023

Quantum System Stability and Reproducibility Workshop 2023

Conference Reviewer

International Conference on Learning Representations (ICLR) 2024

Neural Information Processing Systems (NeurIPS) 2023

ACM/IEEE International Workshop on Quantum Computing 2022

Design Automation Conference (DAC) 2021

Journal Reviewer

Quantum Information Processing

Session Chair

IEEE International Conference on Quantum Computing and Engineering (QCE) 2023

2023 IEEE/ACM International Conference on Computer-Aided Design (ICCAD) 2023

REFERENCE

Professor Yiyu Shi — PhD advisor, Professor
yshi4@nd.edu — University of Notre Dame

Professor Peter Kogge — Ted H. McCourtney Professor
Peter.M.Kogge.1@nd.edu — University of Notre Dame

Professor Fred Chong — Seymour Goodman Professor
chong@cs.uchicago.edu — University of Chicago

Professor Yufei Ding — Associate Professor
yufeiding@ucsd.edu — University of California San Diego

Dr Marco Pistoia — Managing Director, Distinguished Engineer
marco.pistoia@jpmchase.com — JPMorgan Chase & Co