

Jinguo Liu (刘金国)

POSTDOC FELLOW IN HARVARD UNIVERSITY

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“朝正确的方向努力，而不是去摘下垂的果实。”

Education

Nanjing Institute of Technology

Nanjing

B.S. IN SOFTWARE ENGINEERING

2008–2012

I was a pioneer of the open-source software movement in my institute. Deeply impressed by the beautiful computation framework in the book "Quantum Computation and Quantum Information" by Michael A. Nielsen, I was eager to learn more about quantum computing.

Nanjing University

Nanjing

PH.D. THEORETICAL PHYSICS

2012–2017

Advised under Prof. Qianghua Wang, I built up my interest in algorithms for solving quantum many-body systems. I mastered tensor networks algorithms and renormalization group theories and became a geek in simulating quantum many-body systems. Most of my works are about designing new algorithms to solve problems in physics, like the multi-channel Kondo problem and fractional topological excitation. In the last year as a doctoral candidate, I won the first prize in the ZTE fantastic algorithm challenge, which reflects my solid algorithmic background in matrix computation and combinatorial optimization.

Skills

Programming Julia, Python, Fortran

Language Chinese, English

Knowledge Tensor Networks, Differential Programming, Quantum computing, Computational complexity, Condensed matter physics, Combinatorial optimization, High performance computing

Experience

Institute of Physics (IOP), Chinese Academy of Sciences (CAS)

Beijing, China

POSTDOC

2017–2019

I became a postdoc in [Lei-Wang's](#) group, one of the smartest people I knew. Besides providing valuable advice about research, Lei also provides opportunities for me to give lectures and talks at international conferences and summer schools. At that time, my research interest is automatic differentiation and quantum algorithms.

QuEra Computing Inc.

Waterloo, Canada

CONSULTANT

2020.01–2020.07

Due to the COVID, I was trapped in Waterloo - a wild place where you can see wild animals on the streets. QuEra kindly offered me a full-time consultant job. I worked on stochastic optimizers for variational quantum algorithms and classical benchmarking quantum approximation optimization algorithm (QAOA).

Harvard university

Boston, United States

POSTDOC

2020.08–2022.08

QuEra also sponsored my Postdoc in Mikhail Lukin's group. Working at Harvard is a unique experience for me. While my skills helped experimentalists and theorists in Misha's group, I learned more exciting stuff from people around me every day.

- I developed generic tensor networks (tensor networks with generic element types) to understand the solution space properties of the maximum independent set problem. I learned their approach to analyzing hardness from the solution space geometry: the overlap gap property and adiabatic gap analysis.
- I mapped the maximum independent set problem on a general graph to the one with restricted geometry of diagonal-coupled unit-disk grid graph that Rydberg atom arrays can implement (has been patented). I learned how to reduce many other hard problems to the maximum independent set problem.
- I improved SLM hologram computation for generating arbitrary optical traps (will be patented). I learned how Fourier optics plays a role in the Rydberg atom experiment works in turn.

Hong Kong University of Science and Technology (Guangzhou)

Guangzhou, China

ASSISTANT PROFESSOR

2022.09–

My current position is an assistant professor at Hong Kong University of Science and Technology (Guangzhou). I am ready to take new challenges.

Honors & Awards

2007 **First prize**, Physics Olympiad
 2016 **Academic Excellence Scholarship**, Nanjing University
 2017 **First prize (out of 8000 teams, 100,000 RMB award)**, ZTE Fantastic Algorithm Challenge

JiangSu, China
 NanJing
 Xi An, China

Open Source Contributions

Yao.jl

ONE OF THE MAIN DEVELOPERS

Yao.jl is the most popular quantum circuit simulation framework in the Julia community. The Yao repository has 650+ Github stars, and the paper has 50+ citations. It is fast, generic, GPU accelerated, and differentiable.

OMEinsum.jl and OMEinsumContractionOrders.jl

MENTOR OF OMEINSUM.JL, MAIN DEVELOPER OF OMEINSUMCONTRACTIONORDERS.JL

OMEinsum.jl is a generic, differentiable einsum library with GPU support. It was developed by Andreas Peter (mentor under me) on the [Google Summer of Code \(GSoC\)](#) project about differential programming tensor networks. This project is a successful one and now its Github repo has 100+ stars. **OMEinsumContractionOrders.jl** is its extension for contraction order optimization that many state-of-the-art algorithms implemented in it.

GenericTensorNetworks.jl

MAIN DEVELOPER

GenericTensorNetworks.jl is a package using generic tensor network contraction for solving graph properties. It comes together with the paper: "Computing solution space properties by generic programming tensor networks" (see section "Selected Publications").

Presentations

The FOR 1807 Winter School on Numerical Methods for Strongly Correlated Quantum Systems

LECTURER

Lecture: "Deep learning and quantum many body systems"

Marburg

2018

Deep Learning and Quantum Programming: A Spring School

LECTURER

Lecture: [Quantum computing](#)

Dongguan

2019

SLAC Photon Science Seminar

INVITED SPEAKER

Talk: Computing solution space properties of combinatorial optimization problems via generic tensor networks

Virtual

2022

March Meeting 2020

INVITED SPEAKER

Talk: "Differentiable programming tensor networks and quantum circuits"

Cancelled

2020

March Meeting

SPEAKER

Talk: "Differentiale Quantum Circuits and Generative Modeling"

Boston

2019

Juliacon

SPEAKER

Talk: "Differential Programming Tensor Networks"

Baltimore

2019

Statistic Physics and Machine Learning

SPEAKER

Talk: "Machine Learning in frustrated quantum spin system"

An Qing

2018

Computational Approaches for Quantum Many Body Systems

SPEAKER

Talk: "Local indistinguishability and topological phase of matter"

Bei Jing

2016

Beijing 2018 Julia Meetup

SPEAKER

Talk: Tutorial for high performance matrix computations in Julia

Bei Jing

2018

Quantum Information for Developers

HACKATHON

Hackathon: "Funny Tensor Networks"

Zurich

2018

23rd Annual Conference on Quantum Information Processing

POSTER

Poster: "Yao - A differential quantum programming framework"

Shenzhen

2020

The 8th Workshop on Quantum Many-Body Computation

POSTER

Poster: "Differentiable learning of quantum circuit Born machine"

Hang Zhou

2018

The 8th Workshop on Quantum Many-Body Computation

POSTER

Poster: "Differentiable learning of quantum circuit Born machine"

Hang Zhou

2018

The First International Conference on Machine Learning and Physics

POSTER

Poster: "Differentiable learning of quantum circuit Born machine"

Bei Jing

2018

Selected Publications

Quantum optimization with arbitrary connectivity using Rydberg atom arrays

[arXiv:2209.03965](#)

MINH-THI NGUYEN, JIN-GUO LIU, JONATHAN WURTZ, MIKHAIL D LUKIN, SHENG-TAO WANG, HANNES PICHLER

2022

Computing solution space properties by generic programming tensor networks

[arXiv: 2205.03718](#)

JINGUO LIU, XUN GAO, SHENGTAO WANG, MIDELYN CAIN AND MIKHAIL LUKIN

2022

Tropical tensor network for ground states of spin glasses

Phys. Rev. Lett. 126, 090506

JINGUO LIU, LEI WANG AND PAN ZHANG

2021

Yao.jl: Extensible, Efficient Framework for Quantum Algorithm Design

Quantum

XIUZHE LUO, JINGUO LIU, PAN ZHANG AND LEI WANG

2020

For more, please check my [google scholar profile](#).