Yipeng Huang

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Academic Appointments

Rutgers University
Assistant Professor — September 2020–present

Princeton University
Postdoctoral Research Associate — June 2018–August 2020
Advisor: Dr. Margaret Martonosi

Education

Columbia University
Ph.D., computer science — 2018
Dissertation: Hybrid Analog-Digital Co-Processing for Scientific Computation
Advisor: Dr. Simha Sethumadhavan

M.Phil., computer science — 2015
M.S., computer science — 2013
B.S. *magna cum laude*, computer engineering, minor in economics — 2011

Honors and Awards

- IEEE Micro Top Picks from the Computer Architecture Conferences honorable mention: 2018, 2022
- Rising Stars in Computer Architecture Workshop 2019 participant (one of seven)
- Heidelberg Laureate Forum 2017 participant
- IEEE Micro Top Picks from the 2016 Computer Architecture Conferences (one of 12)
- DARPA Small Business Technology Transfer Phase I grant (for investigating analog computing applications)
- Columbia University Computer Engineering Award of Excellence (annual departmental award)
- Columbia University George Vincent Wendell Memorial Medal nominee (annual school award)

Publications

Conference Publications

Qubit Movement-Optimized Program Generation on Zoned Neutral Atom Processors
Enhyeok Jang, Youngmin Kim, Hyungseok Kim, Seungwoo Choi, Yipeng Huang, and Won Woo Ro
International Symposium on Code Generation and Optimization (CGO), Las Vegas, NV, 2025

Tetris: A Compilation Framework for VQA Applications in Quantum Computing
Yuwei Jin, Zirui Li, Fei Hua, Tianyi Hao, Huiyang Zhou, Yipeng Huang, and Eddy Z. Zhang
ACM/IEEE International Symposium on Computer Architecture (ISCA), Buenos Aires, Argentina, 2024
Distinguished Artifact Award

Noisy Variational Quantum Algorithm Simulation via Knowledge Compilation for Repeated Inference
Yipeng Huang, Steven Holtzen, Todd Millstein, Guy Van den Broeck, and Margaret Martonosi
ACM International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS), Detroit, MI, 2021
Acceptance rate $= 75/398 \approx 18.8\%$
IEEE Micro Top Picks from the 2021 Computer Architecture Conferences honorable mention

Statistical Assertions for Validating Patterns and Finding Bugs in Quantum Programs
Yipeng Huang and Margaret Martonosi
ACM/IEEE International Symposium on Computer Architecture (ISCA), Phoenix, AZ, 2019
Acceptance rate $= 62/365 \approx 17.0\%$

Hybrid Analog-Digital Solution of Nonlinear Partial Differential Equations
Yipeng Huang, Ning Guo, Mingoo Seok, Yannis Tsividis, Kyle Mandli, and Simha Sethumadhavan
IEEE/ACM International Symposium on Microarchitecture (MICRO), Cambridge, MA, 2017
Acceptance rate $= 61/327 \approx 18.7\%$
IEEE Micro Top Picks from the 2017 Computer Architecture Conferences honorable mention

Evaluation of an Analog Accelerator for Linear Algebra
Yipeng Huang, Ning Guo, Mingoo Seok, Yannis Tsividis, and Simha Sethumadhavan
ACM/IEEE International Symposium on Computer Architecture (ISCA), Seoul, South Korea, 2016
Acceptance rate $= 57/291 \approx 19.6\%$
IEEE Micro Top Picks from the 2016 Computer Architecture Conferences

RoboBench: Towards Sustainable Robotics System Benchmarking
Jonathan Weisz, Yipeng Huang, Florian Lier, Simha Sethumadhavan, and Peter K. Allen
IEEE International Conference on Robotics and Automation (ICRA), Stockholm, Sweden, 2016

Continuous-Time Hybrid Computation with Programmable Nonlinearities
Ning Guo, Yipeng Huang, Tao Mai, Sharvil Patil, Chi Cao, Mingoo Seok, Simha Sethumadhavan, and Yannis Tsividis
European Solid-State Circuits Conference (ESSCIRC), Graz, Austria, 2015
Invited for submission to the IEEE Journal of Solid-State Circuits

Journal Publications

Towards an Accelerator for Differential and Algebraic Equations Useful to Scientists
J. Garcia-Mallen, S. Ping, A. Miralles-Cordal, I. Martin, M. Ramakrishnan and Y. Huang
IEEE Computer Architecture Letters, vol. 22, no. 2, pp. 185-188, July-Dec. 2023

Architectures / Systems: Dynamical Systems: Differential Equation Solving
Yipeng Huang
International Roadmap for Devices and Systems (IRDS), chapter on Beyond CMOS and Emerging Research Materials. 2022.

Analog Computing in a Modern Context: A Linear Algebra Accelerator Case Study
Yipeng Huang, Ning Guo, Mingoo Seok, Yannis Tsividis, and Simha Sethumadhavan
IEEE Micro, Top Picks Special Issue, vol. 37, no. 3, pp. 30-38, 2017

Energy-Efficient Hybrid Analog/Digital Approximate Computation in Continuous Time
Ning Guo, Yipeng Huang, Tao Mai, Sharvil Patil, Chi Cao, Mingoo Seok, Simha Sethumadhavan, and Yannis Tsividis
IEEE Journal of Solid-State Circuits (JSSC), vol. 51, no. 7, pp. 1514-1524, July 2016

Trustworthy Hardware from Untrusted Components
Simha Sethumadhavan, Adam Waksman, Matthew Suozzo, Yipeng Huang, and Julianna Eum
Communications of the ACM, vol. 58, no. 9, pp. 60-71, August 2015"

Workshop Papers

A Qudit Stabilizer Circuit Simulator
Adeeb Kabir, Anika Kumar, Steven Nguyen, and Yipeng Huang
The Sixth Young Architect Workshop at ACM International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS), 2024

The Approximation of Density Matrices
Zirui Li and Yipeng Huang
The Sixth Young Architect Workshop at ACM International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS), 2024

Towards an Accelerator for Differential and Algebraic Equations Useful to Scientists
Jonathan Garcia-Mallen, Shuohao Ping, Alex Miralles-Cordal, Ian Martin, Mukund Ramakrishnan, and Yipeng Huang
2nd Workshop on Democratizing Domain-Specific Accelerators at IEEE/ACM International Symposium on Microarchitecture (MICRO), 2023

Logic Formulas as Program Abstractions for Quantum Circuits : A Case Study in Noisy Variational Algorithm Simulation
Yipeng Huang, Steven Holtzen, Todd Millstein, Guy Van den Broeck, and Margaret Martonosi
First International Workshop on Quantum Computing Software at The International Conference for High Performance Computing, Networking, Storage, and Analysis (SC), 2020

QDB: From Quantum Algorithms Towards Correct Quantum Programs
Yipeng Huang and Margaret Martonosi
PLATEAU Workshop at ACM conference on Systems, Programming, Languages and Applications: Software for Humanity (SPLASH), Boston, MA, 2018

Dissertation

Hybrid Analog-Digital Co-Processing for Scientific Computation
Committee: Simha Sethumadhavan, Yannis Tsividis, Margaret Martonosi, Martha Kim, and Kyle Mandli
Nominated by Columbia University Computer Science Department for the ACM Doctoral Dissertation Award

Grants and Gifts

Research on Quantum Pulse Latency Reduction through Quantum Optimal Control Framework
Funded international collaboration via National Research Foundation of Korea (NRF),
Quantum Information Science and Human Resources Development Program

A hybrid quantum and classical computing software platform
4/12/2023; Grant amount: $25,000; Columbia University Millard Chan '99 Technology Challenge Award

I-Corp: A quantum and classic bridge
2/15/2023–7/31/2024; Grant amount: $50,000; NSF award number TI-2311595

Hybrid Analog-Digital Co-Processor for Scientific Computation
I was the principal investigator for this Small Business Technology Transfer grant,
in response to DARPA's Accelerated Computation for Efficient Scientific Simulation (ACCESS) program.
The research was conducted at a startup I founded, Allegory Labs, LLC, with Columbia University as a subcontractor.
Grant amount: $100,000; DoD DARPA contract number D16PC00089

Research Artifacts & Impact

Columbia University Prototype Analog Accelerators
I was a part of a team that taped-out two iterations of analog accelerators for solving differential and algebraic equations.
I led the effort in building the chips' digital interfaces, validating the chips' functionality, and programming the chips.
The prototypes have been used at MIT, Ulm University, Sendyne Corporation, and Allegory Labs, LLC for further research.

Press Mentions

Headline	Publication	Date
Quantum computing: Finding solutions by the people for the people	phys.org	Aug. 9, 2024
Columbia Entrepreneurs Win Seed Funding at Millard Chan '99 Tech Challenge	Columbia News	Apr. 28, 2023
Quantum computing made easier through new debugging tools	Science Times	July 4, 2019
Researchers make steps toward debugging tools for quantum computers	phys.org	June 21, 2019
Not your father's analog computer	IEEE Spectrum	Dec. 1, 2017
Maths on a boat: Yipeng Huang and analog computing	maths.org Plus magazine	Oct. 10, 2017
Back to analog computing: Columbia researchers merge analog and digital computing on a single chip	Columbia CS press release	Nov. 22, 2016

Teaching Experience

Role	Course	Primary instructor	Term
Instructor	Rutgers University 16:198:672 & 16:198:558 & 01:198:443 Quantum Computing: Programs and Systems (graduate course in quantum applications and realizations)	-	Fall 2020, Fall 2021, Fall 2022, Spring 2024
Instructor	Rutgers University 01:198:211 Computer Architecture (undergraduate course in C, architecture, and digital logic)	-	Spring 2021, Spring 2022, Spring 2023, Spring 2024
Mentor	Computer Science independent study mentor for Tijil Kiran, Rut Mehta, Neel Shejwalkar, Jackson Lee, and Mukund Ramakrishnan *Lee received the Barry Goldwater Scholarship in 2023*	-	2022 - 2024
Mentor	Computer Science Honors Capstone Program mentor for Anika Kumar, Mayank Barad, Arpan Gupta, Cyrus Majd, and Alex Miralles-Cordal *Kumar's work won the departmental Hagerty Award* *Gupta's work won the Henry Rutgers Scholar Award*	-	2022 - 2024
Mentor	Aresty Research Assistant Program mentor for Pedro Torres, Parth Karekar, Maria Xu, Steven Nguyen, Arpan Gupta, Michael Schleppy, Ian Martin, and Aayushi Kasera *Gupta and Schleppy's work won the first place at the ACM Student Research Competition undergraduate division at PACT 2022*	-	2021 - 2024
Mentor	Undergraduate thesis advisor for Soham Palande *Palande's work won the 2022 Chancellor-Provost's Research Excellence Award*	-	2021 - 2022
Mentor	Quantum Undergraduate Research at IBM and Princeton (QURIP) mentor for Emma Dasgupta and Lia Yeh *Their work won the bronze medal at the ACM Student Research Competition undergraduate division at MICRO 2019*	Margaret Martonosi	Summer 2019
Mentor	Undergraduate thesis mentor for Lois Dzebissov	Margaret Martonosi	Fall 2018
Mentor	Undergraduate research project mentor for Lusa Zhan	Simha Sethumadhavan	Fall 2016
Mentor	Masters research project mentor for Mingrui Liu	Simha Sethumadhavan	Spring 2015
Mentor	Masters research project mentor for Kenneth Harvey	Simha Sethumadhavan	Spring 2015
Teaching assistant	Columbia University EECS 4340 Computer Hardware Design (graduate course in RTL design, validation, synthesis)	Simha Sethumadhavan	Fall 2012, Fall 2014
Teaching assistant	Columbia University CSEE 3827 Fundamentals of Computer Systems (undergraduate course in logic and architecture)	Dan Rubenstein	Fall 2010
Teaching assistant	Columbia University COMS 1007 Object Oriented Design in Java	Bert Huang	Spring 2010

Academic Service

Role	Venue	Years
PC	ACM International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS)	2024
PC	ACM/IEEE International Symposium on Computer Architecture (ISCA)	2023
PC	IEEE International Symposium on High Performance Computer Architecture (HPCA)	2021, 2022, 2023
PC	IEEE/ACM International Symposium on Microarchitecture (MICRO)	2020, 2021, 2022
PC	IEEE International Conference on Quantum Computing and Engineering	2021, 2022
PC	International Workshop on Quantum Software Engineering	2022
PC	Brookhaven National Laboratory New York Scientific Data Summit	2020
PC	Programming Languages and Quantum Computing workshop at POPL/PLDI	2020, 2021
ERC	ACM/IEEE International Symposium on Computer Architecture (ISCA)	2019, 2020, 2022, 2025
ERC	ACM International Conference on Architectural Support for Programming Languages and Operating Systems (ASPLOS)	2019, 2020, 2021, 2025
ERC	IEEE International Symposium on High Performance Computer Architecture (HPCA)	2024, 2025
ERC	IEEE/ACM International Symposium on Microarchitecture (MICRO)	2019, 2024
Reviewer	ACM Transactions on Quantum Computing (TQC)	2020, 2024
Reviewer	ACM Transactions on Architecture and Code Optimization (TACO)	2024
Reviewer	IEEE Micro Magazine	2017, 2018, 2021
Registration chair	ACM/SIGARCH International Conference on Supercomputing (ICS)	2021
Session chair	ACM/IEEE International Symposium on Computer Architecture (ISCA)	2023
Session chair	IEEE International Symposium on High Performance Computer Architecture (HPCA)	2021
Session chair	IEEE/ACM International Symposium on Microarchitecture (MICRO)	2020
Dissertation committee	Yuwei Jin, Rutgers University	2024
Dissertation committee	Fei Hua, Rutgers University	2024
Dissertation committee	Xin Hong, University of Technology Sydney	2023
Dissertation committee	Mohammadreza Soltaniyeh, Rutgers University	Jul. 12, 2022
Examiner	Qualifier exam, Edgar Granados, Rutgers University	May 12, 2023
Examiner	Qualifier exam, Yuwei Jin, Rutgers University	May 9, 2023
Examiner	Qualifier exam, Vihan Shah, Rutgers University	Nov. 11, 2022
Examiner	Qualifier exam, Fei Hua, Rutgers University	Sep. 13, 2021
Examiner	Qualifier exam, Anastasios Stathopoulos, Rutgers University	April 23, 2021
Examiner	Qualifier exam, Shuchang Liu, Rutgers University	Nov. 24, 2020

Science Education Outreach, Leadership, and Professional Memberships

Organization	Role	Years
Computer and Information Science and Engineering (CISE) Graduate Fellowships (CSGrad4US)	Reviewer	2022
Undergrad Architecture Mentoring (uArch) Workshop	Panelist	2022
Summer Science Program (high school astrophysics summer program)	Admissions committee	2019, 2020, 2021, 2022
New York Hall of Science STEM Night: Exploring the Tech Workforce	Panelist	October 2019
UC Santa Barbara School for Scientific Thought (high school quantum computing weekend program)	Short course instructor	October 2019
FIRST Robotics Competition (high school annual robotics competition)	Team mentor	Spring 2014
Western Aerospace Scholars at the Seattle Museum of Flight (high school aerospace summer program)	Summer residency mentor	2012, 2013
Columbia Daily Spectator	Staff director & design editor	2007–2010
ACM SIGARCH, SIGMICRO	Member	2012–present

Professional Experience

Sendyne — New York, NY
Research Intern — Summer 2017
- Developed novel stochastic application-specific integrated circuit for financial modeling applications

Allegory Labs, LLC — New York, NY
Founder & Principal Investigator — Nov. 2015–May 2017
- Founded IP-backed startup via $100K Small Business Technology Transfer federal government contract
- Collaborated with university subcontractor to research new class of analog continuous-time numerical methods
- Identified and assessed commercial potential in modern scientific computation applications
- Communicated with DARPA in-person and in response to request for information, phase I, and phase II proposals

Boeing — Seattle, WA
Information Technology Career Foundation Program Participant — June 2011–July 2012
- Built MPI interface to parallelize computational fluid dynamics and engineering geometry applications

ZS Associates — New York, NY
Business Information Specialist Intern — Summer 2010

Hutchison Port Holdings — Hong Kong
Information Technology Intern — Summer 2009

Technical Tools & Languages

Quantum: IBM Qiskit, Google Cirq, Microsoft ProjectQ, Scaffold

Hardware: SystemC, SystemVerilog, Synopsys, Cadence, Xilinx, Altera EDA tools for ASIC/FPGA

Software: Nvidia CUDA Thrust, Open MPI, Robot Operating System, C/C++, Java, Python, MATLAB, Docker