Ching-Yi Lin, PhD

(412)225-7345
chingyil@umd.edu
8223 Paint Branch Dr., College Park, MD 20740
https://www.andrew.cmu.edu/user/chingyil/
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RESEARCH INTERESTS

Energy-efficient circuits, nonlinear model training, biosensor design, and machine learning accelerators.

ACADEMIC EXPERIENCE

Postdoctoral Associate *March 2025 - Present*
University of Maryland, College Park

- Advisor: Sahil Shah
- Research works
  - Developed 3-bit model integerization algorithm to reduce the precision required during the inference stage
  - Realized low-bit vision transformer on systolic array using FPGA targeting data-center ML inference.
  - Led tapeout for switched capacitor-based accelerator in TSMC 28nm targeting energy-efficient ML inference.
  - Trained model considering non-linearity and process variations in resistive SkyWater 130nm RAM (ReRAM).
- Member of the Hybrid-AI team building in-silicon networks receiving inputs sensed directly from neuron cell signals.
- Co-lectured *Embedded Machine Learning*

EDUCATION

Ph.D. in Electrical and Computer Engineering *August 2018 - December 2024*
Carnegie Mellon University, Pittsburgh, PA
Dissertation title: A Multi-Modal Computational Framework for in vitro Cancer Cell Analysis Based on Capacitance Sensing and Optical Imaging
Advisor: Marc Dandin, Daniel Bankman (2019-2020), and Radu Marculescu (2018-2019)
Eta Kappa Nu (HKN) Society
Recipient of CMLH Translational Fellowship

M.S. in Electrical and Computer Engineering *August 2018 - December 2022*
Carnegie Mellon University, Pittsburgh, PA

B.S. in Electrical Engineering *August 2013 - June 2017*
National Tsing Hua University (NTHU), Hsinchu, Taiwan
Class Representative

WORK EXPERIENCE

Digital Circuit Design Intern *Summer 2021*
Apple Inc.

- Manager: Amrinder Barn
- Designed and evaluated customized SRAM cells at schematic level
- Modeled and optimized high-speed transmission lines

Software Engineer Intern *Summer 2016*
Industrial Technology Research Institute (ITRI), Taiwan

- Research group: Information and communications research laboratories
- Manager: Li-Han Chen
- Installed Android 5.1 on Odroid-C2, a 64-bit quad-core SBC
- Ported Secure Virtual Mobile Platform (SVMP) on Android 5.1

HONORS AND AWARDS

UMD High Performance Cluster Credit (estimated $2,000+$500) *2025~2026*
Proposal topics: Low-bit Integerized Model Training
Equivalent to 1,400 H100 hours (2025) + 350 H100 hours (2026)

CMLH Translational Fellowship *2024*
Proposal topics: Towards Long-term Data-driven Assays with Non-Visual Sensors
Sponsored by the Center for Machine Learning and Health (CMLH)

IEEE Circuits and Systems Society Student Travel Grants ($350) *2024*
Topics: Towards a Lab-on-a-Chip as a Service (LoCaaS) Framework for *in Vitro* Cancer Cell Assays

Carnegie Institute of Technology Dean's Fellow *2018*

SUBMITTED GRANTS

The W. M. Keck Foundation Research program *September 2026*
Project title: The Glial Half of Learning: A Closed-Loop Optoelectronic Instrument to Reveal How Astrocytes Orchestrate Memory in Living Neural Networks

BWF Career Awards at the Scientific Interface (CASI) *August 2026*
Project title: Circuit Learns Like Brain

DoE Genesis *April 2026*
Project title: AI-Driven Co-Design of Event-Driven Neuromorphic Architectures Using Non-Volatile Analog Devices

DARPA Mapping Machine Learning to Physics (ML2P) *October 2025*
Proposal title: Logical Encoding for Efficient Neural-Networks (LEEN)

Maryland Industrial Partnerships (MIPS) *May 2025*
Project title: Development of VOC Detection Sensor Array

TEACHING EXPERIENCE

Co-instructor, Embedded Machine Learning *Fall 2025*
University of Maryland, College Park

- Graduate-level course co-taught with Prof. Sahil Shah
- Topics: Transformer models, model quantization/integerization, switched capacitor arrays.

Teaching Assistant
Carnegie Mellon University

- Analog Integrated Circuit Design (Prof. Marc Dandin) *Fall 2023*
- Intro to Machine Learning for Engineers (Prof. Carlee Joe-Wong) *Spring 2022*

Teaching Assistant
NTHU

- Embedded System Lab (Prof. Jing-Jia Liou) *Spring 2017 & 2018*
- Advanced Computer Architecture (Prof. Yarsun Hsu) *Fall 2017*
- Introduction to C Programming (Prof. Mi-Chang Chang) *Fall 2016*

BOOK AND BOOK CHAPTERS

[B1] **Ching-Yi Lin**, Md Sakibur Sajal, Yann Gilpin, Fahimeh Dehghandehnavi, Anna Batueva, Kai-Chun Lin, Nicole McFarlane, and Marc Dandin. "CMOS bioelectronics: Current and future trends." Bioelectronics (2022): 93-107.

JOURNAL PAPERS

[J8] Irem Didin, Carl Brando, **Ching-Yi Lin**, and Sahil Shah. "Characterization and Modeling of Multilevel Analog ReRAM Synapses in the Sky130 Process." IEEE Journal on Exploratory Solid-State Computational Devices and Circuits (2026).

[J7] Yongmin Baek, Byungjoon Bae, Hyojin Shin, Charaana Sonnadara, Haein Cho, **Ching-Yi Lin**, Yujia Mu, Cong Shen, Sahil Shah, Gunuk Wang, and Kyusang Lee. "Edge intelligence through in-sensor and near-sensor computing for the artificial intelligence of things." , 2(1), p.25 (2025).

[J6] Yann Gilpin, **Ching-Yi Lin**, and Marc Dandin. "Evaporation and focus degradation mitigation in in-incubator live cell imaging for capacitance lab-on-CMOS microsystem calibration." Review of Scientific Instruments, 96(9) (2025).

[J5] **Ching-Yi Lin** and Marc Dandin. "Machine Learning Identification and Classification of Cancer Cell Behaviors in a Lab-on-CMOS Capacitance Sensing Platform." IEEE Journal of Biomedical and Health Informatics, doi: 10.1109/JBHI.2024.3486251 (2024).

[J4] Kyle Smith, **Ching-Yi Lin**, Yann Gilpin, Elizabeth Wayne, and Marc Dandin. "Measuring and modeling macrophage proliferation in a lab-on-CMOS capacitance sensing microsystem." Frontiers in Bioengineering and Biotechnology, 11: 1159004 (2023).

[J3] Yuwei Qin, Ruben Purdy, Alec Probst, **Ching-Yi Lin**, and Jian-Gang Zhu. "Non-Linear CNN-Based Read Channel for Hard Disk Drive With 30% Error Rate Reduction and Sequential 200-Mbits/s Throughput in 28-nm CMOS." IEEE Journal of Solid-State Circuits, 58, no. 4: 1094-1105 (2023).

[J2] Yuwei Qin, Ruben Purdy, Alec Probst, **Ching-Yi Lin**, and Jian-Gang Zhu. "ASIC Implementation of Nonlinear CNN-Based Data Detector for TDMR System in 28 nm CMOS at 200 Mbits/s Throughput." IEEE Transactions on Magnetics, 59, no. 3: 1-8 (2022).

[J1] Kartikeya Bhardwaj, **Ching-Yi Lin**, Anderson Sartor, and Radu Marculescu. "Memory- and communication-aware model compression for distributed deep learning inference on IoT." ACM Transactions on Embedded Computing Systems (TECS), 18, no. 5s: 1-22 (2019).

CONFERENCE PAPERS

[C8] **Ching-Yi Lin**, and Sahil Shah. "Design Space Exploration for ReRAM-based Architectures to Address Scaling Non-idealities." 2026 IEEE 69th International Midwest Symposium on Circuits and Systems (MWSCAS).

[C7] Kaushik Lakshmiramanan, Vineeta Nair, **Ching-Yi Lin**, Sheng-Yu Peng, and Sahil Shah. "An Asynchronous Delta Modulator for Spike Encoding in Event-Driven Brain-Machine Interface." 2026 IEEE 69th International Midwest Symposium on Circuits and Systems (MWSCAS).

[C6] Everest Bloomer, Irem Didin, **Ching-Yi Lin** and Sahil Shah. "Ising-ReRAM: A Low Power Ising Machine ReRAM Crossbar for NP-Complete Problems." 2026 IEEE International Symposium on Circuits and Systems (ISCAS), Shanghai, China, 2026, pp. 1002-1006, doi: 10.1109/ISCAS66217.2026.11562007.

[C5] **Ching-Yi Lin**, and Sahil Shah, "Low-Bit Integerization of Vision Transformers Using Operand Reordering for Efficient Hardware," 2025 IEEE 68th International Midwest Symposium on Circuits and Systems (MWSCAS), pp. 832-836, doi: 10.1109/MWSCAS53549.2025.11244496.

[C4] **Ching-Yi Lin**, Yann Gilpin, Zixin Chen, Elizabeth Wayne and Marc Dandin. "Towards a Lab-on-a-Chip as a Service (LoCaaS) Framework for in Vitro Cancer Cell Assays." 2024 22nd IEEE Interregional NEWCAS Conference (NEWCAS), pp. 268-272, doi: 10.1109/NewCAS58973.2024.10666355 (2024).

[C3] Yann Gilpin, **Ching-Yi Lin**, Mats Forssell, Siyang Zheng, Pulkit Grover, and Marc Dandin. "Tracking the effects of tumor treating fields on human breast cancer cells in vitro using a capacitance sensing lab-on-CMOS microsystem." 2022 29th IEEE International Conference on Electronics, Circuits and Systems (ICECS), pp. 1-4 (2022).

[C2] Yuwei Qin, Ruben Purdy, Alec Probst, **Ching-Yi Lin**, and Jian-Gang Jimmy Zhu. "Non-linear CNN-based read channel for hard disk drive with 30% error rate reduction and sequential 200Mbits/second throughput in 28nm CMOS." 2022 IEEE Symposium on VLSI Technology and Circuits (VLSI Technology and Circuits), pp. 206-207 (2022).

[C1] **Ching-Yi Lin**, and Radu Marculescu. "Model personalization for human activity recognition." 2020 IEEE International Conference on Pervasive Computing and Communications Workshops (PerCom Workshops), pp. 1-7 (2020).

PREPRINTS AND PENDING PAPERS

[PP4] **Ching-Yi Lin**, Shamik Kundu, Arnab Raha, Sahil Shah. "ReRAM-aware Model Finetuning addressing IV Nonlinearity and Retention Errors." (Submitted to IEEE Transactions on Circuits and Systems for Artificial Intelligence)

[PP3] **Ching-Yi Lin** and Marc Dandin. "Transductive Correlation Filter Cell Detection with Pseudo-Label Adaptation for Lab-on-CMOS Time-Lapse Microscopy." (Submitted to Journal of Biomedical and Health Informatics)

[PP2] Everest Bloomer, Irem Didin, **Ching-Yi Lin** and Sahil Shah. "Ising Calculations for NP-Complete - Comparing Discrete to Nondiscrete ReRAM Acceleration." (Accepted by GOMACTech 2026)

[PP1] **Ching-Yi Lin**, and Sahil Shah. "Systolic Array-based Architecture for Low-Bit Integerized Vision Transformers." arXiv preprint arXiv:2508.20334 (2025).

PUBLISHED DATASETS

[D2] **Ching-Yi Lin**, Yann Gilpin, Marc Dandin, "Lab-on-CMOS Time-Lapse Microscopy Images with Focus Drift from Medium Evaporation", IEEE Dataport, January 28, 2026, doi:10.21227/ez4c-7x47

[D1] Kyle Smith, **Ching-Yi Lin**, Yann Gilpin, Elizabeth Wayne, Marc Dandin, "Measuring and Modeling Macrophage Growth Using a Lab-on-CMOS Capacitance Sensing Microsystem", IEEE Dataport, April 6, 2023, doi:10.21227/h4bm-ac75

COMPETITIONS

IEEE Signal Processing Cup *March 2017*
Hardware Designer

- *Excellent video and entertaining concept* Award
- Implemented the signal processing algorithm into embedded system
- Responsible for system design (Raspberry + Arduino), task parallelization, and protocol design.

Eurobot 2016, International Robotics Competition *June 2016*
Software Team Leader

- Led software team of DIT Robotics, including 9 mechanical engineering students, 1 physic student and 1 EE student.
- Responsible for embedded system design and communication protocol design.

OUTREACH ACTIVITIES

Special Session Organizer in IEEE 69th International Midwest Symposium on Circuits and Systems. *2026*
Topic: Machine Learning Inference Using Emerging Non-Volatile Devices

Session Chair in IEEE 69th International Midwest Symposium on Circuits and Systems. *2026*

Session Committee at Qual Practice Sessions from CMU ECE Graduate Organization *2024*

Graduate Student Spotlight, CMU Office of Graduate and Postdoctoral Affairs *2024*

Speaker at Student Panel of CMU New Graduate Student Orientation *2024*

Panelist in CMU ECE Graduate Student Panel *2021*

Panelist in CMU ECE Open House *2020*

Student Contact in Prospective Student's Admission Letter *2020*
Eunseok Lee, Eric Tang, Alhad Daftardar, Yitu Wang, and Luke Sammarone

Excellent video and entertaining concept Award *2017*
IEEE Signal Processing Cup

OTHER ACTIVITIES

Taiwanese Scholar Society *2019-2022*

- President in 2019-2020
- Vice president in 2020-2022

Team Leader, NTHU EE Tennis Team *2014-2015*

REFERENCES

Sahil Shah
Assistant Professor
Electrical and Computer Engineering
University of Maryland, College Park

Marc Dandin
Associate Professor
Electrical and Computer Engineering
Carnegie Mellon University

Carlee Joe-Wong
Professor
Electrical and Computer Engineering
Carnegie Mellon University

L. Richard Carley
Professor
Electrical and Computer Engineering
Carnegie Mellon University

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https://www.andrew.cmu.edu/user/chingyil/docs/cv_chingyi.pdf