Che-Kai Liu

Curriculum Vitae *last update: 11/20/2023*

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General Research Interests

INDEX: Analog/Mix-signal chip design. Compute-In-memory device (RRAM & FeFET), circuit (robust analog sensing, low-power (power/clk-gating) method, etc.), and architecture (3D integration, mix-signal design, etc.). Neuro/symbolic algorithms (vector-symbolic arch., factorization, graph representations, etc.).

Education

2023–present **PhD Student, Electrical & Computer Engineering**, *Georgia Institute of Technology*, Atlanta, GA, USA.
Research Focus: Mix-signal in-memory chip for edge applications.
Advisor: Steve W. Chaddick school chair and Prof., Arijit Raychowdhury

2019–2023 **Bachelor of Engineering, Electrical & Computer Engineering**, *Zhejiang University*, Hangzhou, Zhejiang, P.R.China.

Publications *: Equal Contributions.

DATE 2024 Zhicheng Xu, **Che-Kai Liu**, et al. Ferex: A reconfigurable design of multi-bit ferroelectric compute-in-memory for nearest neighbor search. In *Design Automation and Test in Europe (DATE). Acceptance rate: 25%*. ACM/IEEE, DATE 2024.

DATE 2024 Zishen Wan*, **Che-Kai Liu***, et al. H3dfact: Heterogeneous 3d integrated cim for factorization with holographic perceptual representations. In *Design Automation and Test in Europe (DATE). Acceptance rate: 25%*. ACM/IEEE, DATE 2024.

MLSys 2023 Zishen Wan, **Che-Kai Liu***, Hanchen Yang*, Chaojian Li*, Haoran You*, et al. Towards cognitive ai system: A survey and prospective on neuro-symbolic ai. In *Workshop on Systems for Next-Gen AI Paradigms, Sixth Conference on Machine Learning and Systems*, MLSys 2023.

ICCAD 2023 Shengxi Shou, **Che-Kai Liu**, et al. See-mcam: A scalable multi-bit fefet content addressable memory for energy efficient associative search. In *Proceedings of the IEEE/ACM International Conference on Computer-Aided Design. Acceptance rate: 23%*. IEEE/ACM, ICCAD 2023.

DATE 2023 Hamza E. Barkam, Sanggeon Yun, Paul R. Genssler, Zhuowen Zou, **Che-Kai Liu**, et al. Hdgim: Hyperdimensional genome sequence matching on unreliable highly-scaled fefet. In *Proceedings of the IEEE/ACM Design Automation and Test in Europe. Acceptance rate: 25%*. IEEE/ACM, DATE 2023.

ICCAD 2022 **Che-Kai Liu** et al. Cosime: Fefet based associative memory for in-memory cosine similarity search. In *Proceedings of the 41st IEEE/ACM International Conference on Computer-Aided Design. Acceptance rate: 22%*. IEEE/ACM, ICCAD 2022.

Professional Experience

Georgia Institute of Technology, USA

Aug, 2023 – Present **Graduate Research Assistant**, *Integrated Circuits and Systems Research Lab (ICSRL)*.

Fellowships & Awards

2023 ACM Student Research Competition **Finalist (Ranked 4^{th} worldwide)**.

2023 Outstanding undergraduate thesis award. Thesis title: "Cross-Layer Optimization for Computing-in-Memory Circuits, Architectures and Applications".

2022 **First Place**, ACM Student Research Competition at ACM/IEEE Int'l Conference on Computer-Aided Design (ICCAD), 2022.

2022 **Best** presentation award at ACM/IEEE ESWEEK EIC workshop, 2022.

2022 Research sponsorship from Fellow of IEEE/ACM Prof. X. Sharon Hu, 2022.

2022 Research scholarship from the University of Notre Dame, IN, 2022.

Talks

2023 Oct. SEE-MCAM: A Scalable Multi-bit FeFET Content Addressable Memory for Energy Efficient Associative Search, IEEE/ACM 42^{nd} International Conference on Computer-Aided Design (ICCAD), San Francisco, CA, USA.

2023 May "When Vector Symbolic Architecture meets Compute-in-Memory", ICSR Lab, Georgia Institute of Technology, Virtual

2022 Oct. Student Research Competition, IEEE/ACM 41^{st} International Conference on Computer-Aided Design (ICCAD), San Diego, CA, USA.

2022 Nov. Cosime: Fefet based associative memory for in-memory cosine similarity search, IEEE/ACM 41^{st} International Conference on Computer-Aided Design (ICCAD), 2023, San Diego, CA, USA.

2022 Oct. "Compute-in-Memory: A Cross-Layer Perspective", Bias Lab, University of California, Irvine, CA, USA.

2022 Sep. "An efficient Associative Memory Engine for Cosine Similarity-Based Nearest Neighbor Search", ACM/IEEE Embedded System Week (ESWEEK), Edge Intelligent Computing workshop, virtual.

Skills

Technical Skill (System) Verilog, Digital Tape-out Flow: Synopsys VCS/DC/ICC, Analog Tape-out Flow: Cadence Virtuoso/Calibre/Innovus, Python, C, MATLAB

Reviewer for

2023 **2024 IEEE International Symposium on Circuits and Systems (ISCAS)**.

2022-2023 **IEEE J. on Emerging and Selected Topics in Circuits & Systems (JETCAS)**.

2023 **ACM Journal on Autonomous Transportation Systems (JATS)**.

Research Agencies Participated

2023–present **Cocosys: Center for the Co-Design of Cognitive Systems**, *Center director: Prof. Arijit Raychowdhury*, A Semiconductor Research Co. (SRC) sponsored by Defense Advanced Research Projects Agency (DARPA).

Courses Participated during Ph.D. @ GaTech ECE

Fall, 2023 : **ECE8903: Special Problems**, *Instructor: Prof. Arijit Raychowdhury*.

Fall, 2023 : **ECE6130: Advanced VLSI Systems**, *Instructor: Prof. Arijit Raychowdhury*.

Fall, 2023 : **CS6290/ECE6100: Advanced Computer Architecture**, *Instructor: Prof. Cong (Callie) Hao*.

Fall, 2023 : **ECE4804: VLSI Theory to Tape-out**, *Instructor: Prof. Visvesh S. Sathe*, Audit.