Zhihua Xiao

Ph.D. student in
Electronics and Computer Engineering,
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EDUCATION

Ph.D. in Electronics and Computer Engineering *Sep. 2021 - Present*
The Hong Kong University of Science and Technology
Supervisor: Qiming SHAO

B.Eng. in Microelectronics Science and Engineering *Sep. 2017 - June 2021*
Southern University of Science and Technology
Thesis: *YoLook: All-Int Arithmetic Object Detection Accelerator*
Supervisor: Fengwei AN
Graduation with honor: Magna Cum Laude

RESEARCH EXPERIENCE

Graduate Fellow *Sep. 2021 - Present*
The Hong Kong University of Science and Technology
Supervisor: Qiming SHAO
- In-memory computing using magnetic random-access memory **[L1-4, P2-3]**
- Software-hardware codesign schemes for accurate and efficient neuromorphic computing **[L1-4, P2-3]**
- Configurable neuromorphic in-memory computing using voltage-controlled magnetic tunnel junctions
- Modeling and characterization of spintronic devices **[L1, P1, P3]**

Graduate Fellow, *ResearchProject-1* *Sep. 2021 - Present*
AI Chip Center for Emerging Smart Systems (ACCESS)
Center Director: Tim Kwang-Ting CHENG
- Emerging non-volatile memories for in-memory computing **[L1-4, P2-3]**
- Cross-layer design techniques for in-memory computing systems **[L1-4, P2-3]**
- Device modeling from technology to neuromorphic computing **[L4]**

Research Intern *July 2020 - Oct. 2020*
DOBOT Co., Ltd.
- *Real-time object detection on autonomous robots with RISC-V processor*

Undergraduate Fellow *Sep. 2017 - June 2021*
Southern University of Science and Technology
Supervisor: Fengwei AN
- Energy-efficient machine learning accelerator design **[P4]**
- Object detection coprocessor design **[P5, P6, P7]**
- Algorithm improvement on object detection and its edge acceleration **[Undergraduate Thesis]**

LECTURES & TALKS

[L1] "Ultra-low cycle-to-cycle variation in MRAM for accurate analog in-memory computing," in ACCESS seminar series, 2023

[L2] "Accurate in-memory computing with MRAM device variation-aware adaptive quantization," in 2nd Online RIEC International Workshop on Spintronics, 2023 [Link]

[L3] "Device Variation-Aware Adaptive Quantization for MRAM-based Accurate In-Memory Computing Without On-chip Training," in 2022 International Electron Devices Meeting (IEDM), 2022

[L4] "Adaptive Quantization for In-memory Computing with SOT-MRAM," in ACCESS seminar series, 2022

PUBLICATIONS

[P1] **Xiao, Z.**, Hou, Y., Tong Z., …& Shao, Q. (2024). In-Memory Neural Stochastic Differential Equations with Probabilistic Differential Pair Achieved by In-situ P-bit using CMOS Integrated Voltage-Controlled Magnetic Tunnel Junctions. (Under Review)

[P2] Cheung S.K., **Xiao Z.**, Liu J., Ren Z., & Shao Q. (2024) Tunable intermediate states for neuromorphic computing with spintronic devices. J. Appl. Phys. 136; doi: 10.1063/5.0187647

[P3] **Xiao, Z.**, Naik V.B., Lim J.H., Hou Y., Wang Z., & Shao, Q. (2024). Adapting magnetoresistive memory devices for accurate and on-chip-training-free in-memory computing. (Under Review)

[P4] Ren, Z., Liu, R., Cheung, S., Qian, K., Wu, X., **Xiao, Z.**, ... & Shao, Q. (2024). Strongly temperature-dependent spin–orbit torque in sputtered WTex. Journal of Applied Physics, 135(14).

[P5] **Xiao, Z.**, Naik, V. B., Cheung, S. K., Lim, J. H., Kwon, J. H., Ren, Z., ... & Shao, Q. (2022, December). Device Variation-Aware Adaptive Quantization for MRAM-based Accurate In-Memory Computing Without On-chip Training. In 2022 International Electron Devices Meeting (IEDM) (pp. 10-5). IEEE.

[P6] Liu, Y., Lee, A., Qian, K., Zhang, P., **Xiao, Z.**, He, H., Ren, Z., ... & Shao, Q. Cryogenic in-memory computing using tunable chiral edge states. arXiv 2022. arXiv preprint arXiv:2209.09443. (Under Review)

[P7] Mao, W., **Xiao, Z.**, Xu, P., Ren, H., Liu, D., Zhao, S., ... & Yu, H. (2020, September). Energy-efficient machine learning accelerator for binary neural networks. In Proceedings of the 2020 on Great Lakes Symposium on VLSI (pp. 77-82).

[P8] Xu, P., **Xiao, Z.**, Wang, X., Chen, L., Wang, C., & An, F. (2020). A multi-core object detection coprocessor for multi-scale/type classification applicable to IoT devices. Sensors, 20(21), 6239.

[P9] **Xiao, Z.,** Xu, P., Wang, X., Chen, L., & An, F. (2020). A multi-class objects detection coprocessor with dual feature space and weighted softmax. IEEE Transactions on Circuits and Systems II: Express Briefs, 67(9), 1629-1633.

[P10] An, F., Xu, P., **Xiao, Z.**, & Wang, C. (2019, September). FPGA-based object detection processor with HOG feature and SVM classifier. In 2019 32nd IEEE International System-on-Chip Conference (SOCC) (pp. 187-190). IEEE.

PROFESSIONAL EXPERIENCE

Reviewer Service

- Science Advance *2023*
- Transactions on Magnetics *2023*
- IEEE International Conference on Artificial Intelligence Circuits and Systems *2022*
- Transactions on Electron Devices *2021*

Graduate Teaching Assistant

- ELEC 3310: Digital Fundamentals and Systems Design *Fall 2022*
  Lecturer: YOBAS, Levent
- ELEC 1100: Introduction to Electro-Robot Design
  Lecturer: SHEN, Shaojie; WONG, Man Hoi *Fall 2021*

Professional Certification

- Certification of Competency in Deep Learning of Computer Vision *July 2019*
  NVIDIA Deep Learning Institute

RELATED COURSEWORK

- Machine Learning
- Advanced Computer Architecture
- Machine Learning on Chip
- Advanced Integrated Circuits Design: Microprocessor
- Advanced Topics in AI & Healthcare
- Advanced Analog IC Design
- System-on-chip Design
- Advanced Topic Nanoelectronics

SKILLS

Algorithm related tools: Python, C++, CUDA, OpenAI Triton, HLS C, Pytorch, Tensorflow, SNNTorch, SpikingJelly, IBM Analog Hardware Acceleration Kit

Hardware related tools: Cadence, Synopsys, SPICE, Verilog-A, Verilog, VHDL, Vivado, Prob station, MUMAX3, Comsol

Hardware: FPGA, RISC-V, ARM, SoC, ASIC, SOT-MRAM, STT-MRAM, VCMA-MRAM, Hall-bar devices

HONORS / AWARDS

- RedBird Academic Excellence Award for Continuing PhD Students, HKUST *2023*
- Research Postgraduate Scholarship, HKUST *2023*
- UGC Research Travel Grant, HKUST *2022*
- Student Presenter Travel Grant, IEDM *2022*
- Research Postgraduate Scholarship, HKUST *2022*
- Research Postgraduate Scholarship, HKUST *2021*
- Award of Excellence, 2020 International Competition of Autonomous Running Robots *2020*
- Merit Student Scholarship - First Class, SUSTech *2020*
- Merit Student Scholarship - Third Class, SUSTech *2019*
- Merit Student Scholarship - Third Class, SUSTech *2018*
- Outstanding Freshman Scholarship - First Class, SUSTech *2017*

REFERENCES

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