Mariam Rakka

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Linkedin | Google scholar

Irvine, CA, USA

Objective

An independent, passionate, and hardworking individual seeking to learn new things every single day. Aiming to leverage my expertise in systems for ML to contribute to innovations in the field of hardware acceleration.

Industry Experience

- **Arm, Inc. [🌐]** *06, 2024 - 09, 2024*
  Computer Architecture Research Intern Austin, Texas
  - Characterized prominent Machine Learning workloads and identified bottlenecks using perf and Gem5
  - Conceptualized a specialized hardware accelerator for the identified bottlenecks to enhance performance on Arm-based architectures, particularly those supporting SIMD extensions
  - Estimated the needed hardware resources, including area, cache utilization, and memory bandwidth requirements
  - Conducted a software-hardware co-design of the envisioned Arm hardware which resulted in a promising performance improvement for the ML workloads and led to several pending patents
- **Arm, Inc. [🌐]** *06, 2023 - 09, 2023*
  Computer Architecture Research Intern Austin, Texas
  - Conducted research about a new Arm architecture extension
  - Characterized data analytics benchmark suites on a cluster infrastructure
  - Performed bottleneck analysis using perf and Java Flight Recorder, and identified acceleration opportunities using the Arm architecture extension
- **Arm, Inc. [🌐]** *06, 2022 - 09, 2022*
  Machine Learning Research Intern Austin, Texas
  - Developed a Machine Learning-based framework to automatically discover efficient configurations of an Arm processor design
  - Implemented reinforcement learning, deep neural network, active learning, data preprocessing, and data postprocessing Python scripts
  - Interfaced the ML framework with a hardware simulator using bash scripts

Academic Experience

- **University of California, Irvine [🌐]** *10, 2020 - Present*
  Graduate Student Researcher Irvine, CA
  - Currently leading the effort for proposing a reconfigurable in-memory accelerator for Large Language Model inference in collaboration with KAUST
  - Surveyed mixed-precision neural networks which resulted in a first-author publication in TPAMI
  - Proposed an analytical simulator for an in-memory Hyperdimensional Reinforcement Learning accelerator which resulted in a first-author journal publication in JETC
  - Implemented an accurate functional simulator for faster Decision Tree inference using Python and MATLAB which resulted in a first-author journal publication in TETC
- **King Abdullah University of Science and Technology [🌐]** *04, 2024 - 05, 2024*
  Visiting Student Researcher Thuwal, Saudi Arabia
  - Developed a novel analytical simulator for a reconfigurable in-memory Convolutional Neural Network inference accelerator which resulted in a first-author paper under review
  - Conducted a software-hardware co-design for a proposed in-memory inference accelerator for modules in Large Language Models using Python which resulted in a first-author paper published in DATE
  - Met and discussed new potential Machine Learning acceleration projects with collaborators at KAUST
- **University of California, Irvine [🌐]** *2021, 2022, 2025*
  Teaching Assistant (Intro to Python Programming/Advanced C Programming/Intro to Digital Systems) Irvine, CA
  - Taught students how to solve mathematical formulations and process images using data structures in Python/C as well as introduced them to the basic workings of digital systems
  - Prepared assignments and exams and delivered weekly online and in-person discussion sessions and labs
  - Met regularly with the course Professors to present the progress and developed bash scripts for grading
- **University of California, Irvine [🌐]** *07, 2019 - 09, 2019*
  Hardware Engineering Intern Irvine, CA

- Implemented a hardware based real-time temperature tracking solution on the Nexys Video FPGA
- Utilized the DRP interface of the XADC soft core to tap into the registers where temperature data is stored and customized a FIFO core to store different instances of temperature data
- Designed a DAC module and displayed the analog temperature value on the OLED of the FPGA
- Acquired knowledge about the RISCV processor, the Information Processing Factory Project, Vivado tools, and different FPGA boards
- Extended the internship as a senior-year project collaboration between UCI and AUB and developed dedicated hardware modules for the Trace Abstraction Layer of the Information Processing Factory to enable real-time non-intrusive on-chip FPGA system verification using VHDL and C which resulted in second-author publication in VLSI-SoC and another publication in DATE

- **American University of Beirut [🌐]** *01, 2018 - 06, 2020*
  Undergraduate Student Researcher Beirut, Lebanon
  - Explored the energy, latency, and quality of various state-of-the-art Resistive RAM-based Ternary CAM implementations which resulted in a first-author publication in TCASII
  - Improved the efficiency of rare fail event estimation statistical methodologies by proposing novel hybrid algorithms' designs and testing them
  - Implemented the proposed algorithms in MATLAB/PERL/HSPICE and evaluated them on 16nm SRAM designs, which resulted in two publications in ISCAS

EDUCATION

- **University of California, Irvine** *10, 2020 - Present*
  MS/PhD in Electrical and Computer Engineering Irvine CA
  - MS in Electrical and Computer Engineering conferred in June 2022
  - MS thesis title: "Resistive Content Addressable Memory Design for Decision Tree Acceleration"
  - Expected year of graduation (PhD): 2025
  - GPA: 4.00/4.00

- **American University of Beirut** *08, 2016 - 05, 2020*
  Bachelor of Computer and Communications Engineering Beirut, Lebanon
  - Graduated with high distinction
  - Minored in Mathematics and Business Administration
  - Cumulative GPA: 3.86/4.00

PUBLICATIONS

C=CONFERENCE, J=JOURNAL, S=IN SUBMISSION, L=LETTER, T=THESIS

[C.1] Mariam Rakka, et al. (2025). **SoftmAP: Software-Hardware Co-design for Integer-Only Softmax on Associative Processors**. *2025 Design, Automation & Test in Europe Conference & Exhibition (DATE) (Just Accepted).*

[J.1] Mariam Rakka, et al. (2024). **A Review of State-of-the-Art Mixed-Precision Neural Network Frameworks**. *IEEE Transactions on Pattern Analysis and Machine Intelligence.*

[J.2] Mariam Rakka, et al. (2024). **HDRLPIM: A Simulator for Hyper Dimensional Reinforcement Learning based on Processing In Memory**. *ACM Journal on Emerging Technologies in Computing Systems.*

[S.1] Mariam Rakka, et al. (2024). **BF-IMNA: A Bit Fluid In-Memory Neural Architecture for Neural Network Acceleration**. *ArXiv preprint, arXiv:2411.01417.*

[L.1] Walaa Amer, Mariam Rakka, et al. (2024). **FPonAP: Implementation of Floating Point Operations on Associative Processors**. *IEEE Embedded Systems Letters (Just Accepted).*

[J.3] Mariam Rakka, et al. (2023). **DT2CAM: A Decision Tree to Content Addressable Memory Framework**. *IEEE Transactions on Emerging Topics in Computing.*

[C.2] Walaa Amer, Mariam Rakka, et al. (2023). **Hardware Implementation and Evaluation of an Information Processing Factory**. *2023 IFIP/IEEE 31st International Conference on Very Large Scale Integration (VLSI-SoC).*

[T] Mariam Rakka. (2022). **Resistive Content Addressable Memory Design for Decision Tree Acceleration**.

[C.3] Mariam Rakka, et al. (2021). **Importance Splitting Sample Point Reuse for Efficient Memory Yield Estimation**. *2021 IEEE International Symposium on Circuits and Systems (ISCAS).*

[J.4] Mariam Rakka, et al. (2020). **Design exploration of sensing techniques in 2T-2R resistive ternary CAMs**. *IEEE Transactions on Circuits and Systems II: Express Briefs.*

[C.4] Mariam Rakka, et al. (2020). **Hybrid importance splitting importance sampling methodology for fast yield analysis of memory designs**. *2020 IEEE International Symposium on Circuits and Systems (ISCAS).*

Projects

- **Canny Edge Decoder** *01, 2021 - 04, 2021*
  Tools/Platforms: C, SpecC, RISC-V
  - Designed a multi-threaded version of the Canny Edge Decoder
  - Migrated the sequential C code to a RISC-V Virtual Platform with LCD and Camera device drivers' support
  - Completed a parallel, pipelined system-level design of the Canny Edge Decoder using
  - Received an A for the projects as part of EECS222: Embedded System Modeling and EECS226: Embedded System Software
- **Novel 4-Bit ALU** *01, 2019 - 5, 2019*
  Tools: Cadence
  - Proposed a novel efficient 4-Bit ALU design using modified Shannon theorem
  - Reviewed related works in literature
  - Designed the adder using 90nm technology, and performed schematic-level simulations
  - Demonstrated that the ALU is faster and more power efficient when compared to the CMOS-based design
  - Received an A for the project as part of EECS412L: VLSI Computer Aided Design Lab

Skills

- **Programming Languages:** C, C++, Python, MATLAB, SpecC, HDL (Verilog/VHDL), Gem5, OrCAD PSpice, HSPICE, Perl, Shell Scripting, LaTeX
- **Machine Learning Models:** Large Language Models, Convolutional Neural Networks, Decision Trees, Reinforcement Learning
- **Other Tools:** Perf, Java Flight Recorder, Flame Graphs, Visual Studio Code, Cadence, Github, Overleaf, Microsoft Office programs
- **Specialized Area:** In-memory computing, Hardware acceleration, Statistical analysis methodologies
- **Soft Skills:** Research, Teambuilding, Leadership, Written and verbal communication, Time management

Certifications and Awards

- **iREDEFINE Fellow** *03, 2025*
  National Science Foundation
- **10-week Hardware Design Program** *05, 2023*
  VLSI System Design [🌐]
- **High Level Synthesis Tutorial – DAC 2021** *01, 2022*
  Cadence Design Systems [🌐]
- **DAC'21 Young Fellow** *12, 2021*
  Design Automation Conference [🌐]
- **Best Computer Hardware System Project** *05 2020*
  Maroun Semaan Faculty of Engineering and Architecture [🌐]
- **Dean's Honor List** *09, 2016 - 06, 2020*
  Maroun Semaan Faculty of Engineering and Architecture

Volunteering Experience

- **Youth Member** *10, 2018 - 05, 2019*
  Lebanese Red Cross [🌐]
  - Underwent training courses such as; disseminating humanitarian principles and values, prevention from sexually transmitted diseases and HIV/AIDS, and disaster and preparedness
  - Engaged in activities and helped the elderly segment of Lebanese society.
- **Tutor** *07, 2018 - 08, 2018*
  BASSMA [🌐]
  - Helped children as a part of the Night School Program sponsored by Touch Lebanon
  - Supported public school students in the 7th, 8th, and 9th grades, who are drawn from underprivileged families and face learning difficulties at school
- **Mentor** *08, 2018*
  All Girls Code [🌐]
  - Mentored a hackathon where girls developed apps and made websites tackling tech and health
  - Participated in organizing the hackathon and answering questions, and connected with other mentors
- **Writer** *10, 2018 - 06, 2020*
  AUB Outlook [🌐]
  - Published Arabic articles about different social issues
  - Met with the team of writers and editors on weekly basis

Additional Information

Languages: English (Fluent), Arabic (Fluent), French (Elementary Proficiency)
Interests: Writing articles, Reading novels, Watching crime docu-series, Hiking, Chasing sunsets, Weightlifting