KHYATI KIYAWAT

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INTERESTS

Computer Architecture, Processing-In-Memory(PIM), FPGAs, HW Accelerators, Energy-efficient Computing

EDUCATION

University of Virginia, VA, USA *2022 - present*
Ph. D. Student, Department of Computer Science GPA: 3.8/4.0
Advisor: Prof. Kevin Skadron

Indian Institute of Technology Roorkee, India *2016 - 2020*
B. Tech, Department of Electronics and Communication GPA: 9.23/10.0

ONGOING RESEARCH

Processing-In-Memory is gaining prominence to overcome the *memory wall* issue for data-intensive applications. Despite a lot of research, widespread adoption of PIM remains a concern. Through my research, I aim to narrow this gap by actively focusing on PIM modeling and benchmarking. Currently, I am

- Modeling a bit-serial subarray level PIM architecture (Sieve) proposed for *k-mer* pattern matching on an FPGA-emulation framework (PiMulator). This work is focused on validating the simulation-based performance results of Sieve and extending PiMulator to model various PIM architectures, facilitating design space exploration.
- Developing a comprehensive PIM benchmark suite and investigating a programming model that can be used to express the benchmarks. This work is centered around gaining application-level and architectural insights for the existing and future PIM works.
- Accelerating filter operations in Online Analytic Processing (OLAP) database queries using Alveo U280 FPGA and comparing the performance with a subarray-level PIM architecture (Membrane).

PRESENTATIONS

- **Khyati Kiyawat**, Sergiu Mosanu, Mircea Stan, and Kevin Skadron.
  Open-Source Processing-In-Memory(PIM) Architecture Design through FPGA Emulation: A Case Study Modeling Sieve. *Open-Source Computer Architecture Research Workshop at ISCA, 2023. [OSCAR'23]*
- Akhil Shekar, Lingxi Wu, Kevin Gaffney, Martin Prammer, Helena Caminal, Yimin Gao, **Khyati Kiyawat**, Ashish Venkat, Jose Martinez, Jignesh Patel, and Kevin Skadron.
  Membrane: PiM-based OLAP Database Accelerator. *PRISM Annual Review, UCSD, 2023.*

RESEARCH PROJECTS

Scale-free Hyperbolic CORDIC Architecture | IIT Roorkee, India *Aug. 2019 - Nov. 2021*
- *Advisor:* Prof. Bishnu P Das, ECE Department
- Designed a low-latency CORDIC architecture to compute $\sinh$ and $\cosh$ functions with desired precision.

Power optimization of RISC-V PULPino | Nagoya University, Japan *Dec. 2019 - Feb. 2020*
- *Advisor:* Prof. Tohru Ishihara, Graduate School of Informatics
- Analyzed power consumption by PULPino processor chip for various workloads at different PVT conditions.
- Proposed a real-time Minimum Energy Point tracking method based on a predetermined MEP curve linearly characterized during the boot-phase, observed at most 3.1% energy loss in a 50-stage FO-4 inverter chain.

Image Processing based fish seed counting | IIT Bombay, India *May 2018 - July 2018*
- *Advisor:* Prof. Maryam S Baghini, VLSI Design Lab
- Proposed a novel data-acquisition apparatus to create a training dataset for a crowd-counting-based CNN model.

PUBLICATIONS

- Anu Verma, **Khyati Kiyawat**, Bishnu P. Das, Pramod K. Meher.
  An Efficient Scaling-Free Folded Hyperbolic CORDIC Design Using a Novel Low-Complexity Power-of-2 Taylor Series Approximation. *IEEE Transactions on Very Large Scale Integration (TVLSI), 2023.* [IEEE]
- **Khyati Kiyawat**, Yutaka Masuda, Jun Shiomi and Tohru Ishihara.
  Real-Time Minimum Energy Point Tracking Using a Predetermined Optimal Voltage Setting Strategy.
  IEEE Computer Society Annual Symposium on VLSI (ISVLSI), 2020. [IEEE]

INDUSTRIAL EXPERIENCE

Front-end Design Verification Engineer | Texas Instruments, India *July 2020 - July 2022*
- Verified SoC integration of registers, communication peripherals, and co-processors for C2000 real-time MCUs.
- Handled critical silicon debugs for functional test patterns on Automatic test equipment.

Digital Electronics Intern | Texas Instruments, India *May 2019 - July 2019*
- Standardized memory-mapped register types and designed a Perl-based flow to auto-generate RTL for any IP.

TEACHING AND MENTORING

Graduate Teaching Assistant | University of Virginia, USA *Aug. 2023 - present*
- Computer Systems and Organization, CS 2130

Student Mentorship Programme | IIT Roorkee, India *Aug. 2018 - May 2020*
- Mentored a group of freshers to foster their development and prompt adjustment to the institute's culture.

Rise Together | Charlottesville, Virginia *Oct. 2023 - present*
- Mentoring high-school students in the US and helping them with college application and transition process.

AWARDS AND ACHIEVEMENTS

- Selected to participate in *Computing Research Association-Widening Partition (CRA-WP) Grad Cohort Workshop for Women*, San Francisco, USA, 2023.
- Awarded with *UVA Engineering Distinguished Fellowship 2022* given to the top Ph.D. applicants.
- Qualified as Semi-finalist in *Swadeshi Microprocessor Challenge 2020-21* to build a RISC-V based prototype for autonomous emergency distress system in automobiles.
- Recipient of *Honda Y-E-S Award 2018* awarded to students showing research potential in sustainable technology and also selected for Y-E-S Plus Scholarship 2019 to undergo an internship in Japan.
- Awarded with *1988 Batch Award 2017* given to one undergraduate student based on the academic merit.

SERVICES

Systems Interest Group (SIG) | University of Virginia *Nov. 2022 - present*
- Initiated a cross-departmental forum, orchestrating regular meetings to foster in-depth discussions on cutting-edge research in computer systems, architecture, and networks among faculties and graduate students.

Zero Gravity | IIT Roorkee *Dec. 2018 - Dec. 2021*
- Pioneered an initiative to empower women in STEM through peer mentorship and skill enhancement.

Unnat Bharat Abhiyan | IIT Roorkee *Sep. 2016 - May 2018*
- Contributed to the Govt. of India's initiative, leveraging the technical expertise of IITs to drive rural development.
- Selected as a key participant and developed skills in project management and community outreach.
- Conducted comprehensive surveys to identify operational challenges within agricultural contexts.
- Spearheaded women's health & hygiene awareness campaign in high schools.