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EDUCATION

Ph.D. Candidate in Electrical Engineering, (Sep. 2017 – expected Dec. 2022)
University of Toronto Advisor: Prof. Roman Genov (ECE), Prof. Kyros Kutulakos (CS)
Dual Degree (M.Tech + B.Tech) in Electrical Engineering (Aug 2012 - Jul 2017)
Indian Institute of Technology Madras Advisor: Prof. Nagendra Krishnapura (EE)

SELECTED PUBLICATIONS

Complete list in extended version

CONFERENCES

[ISSCC23] **R. Gulve**, R. Rangel, A. Berman, D. Nguyen, M. Wei, M. A. Sakr, X. Sun, D. B. Lindell, K. N. Kutulakos and R. Genov, "Dual-Port CMOS Image Sensor with Regression-Based HDR Flux-to-Digital Conversion and 80ns Rapid-Update Pixel-Wise Exposure Coding," *In IEEE International Solid-State Circuits Conference-(ISSCC 23)*, 2023
[VLSI22] **R. Gulve***, N. Sarhangnejad*, G. Dutta, M. Sakr, D. Nguyen, R. Rangel, W. Chen, Z. Xia, M. Wei, N. Gusev, E. Y. H. Lin, X. Sun, L. Hanxu, N. Katic, A. Abdelhadi, A. Moshovos, K. N. Kutulakos and R. Genov, "A 39,000 Subexposures/s CMOS Image Sensor with Dual-tap Coded-exposure Data-memory Pixel for Adaptive Single-shot Computational Imaging," *In 2022 IEEE Symposium on VLSI Technology and Circuits (VLSI22)*, pp. 78-79. IEEE, 2022.
[ICCP20] Y. Li, M. Qi, **R. Gulve**, M. Wei, R. Genov, K. Kutulakos and W. Heidrich, "End-to-End Video Compressive Sensing Using Anderson-Accelerated Unrolled Networks," *In IEEE International Conference on Computational Photography*, 2020.
[IISW19] H. Ke, N. Sarhangnejad, **R. Gulve**, Z. Xia, N. Gusev, N. Katic, K. N. Kutulakos and R. Genov, "Extending Image Sensor Dynamic Range by Scene-aware Pixelwise-adaptive Coded Exposure," *In International Image Sensor Workshop*, 2019.
[ISSCC19] N. Sarhangnejad, N. Katic, Z. Xia, N. Gusev, G. Dutta, **R. Gulve**, M. Monero, M. Wei, H. Haim, D. Stoppa, K. Kutulakos and R. Genov, "Dual-Tap Pipelined-Code-Memory Coded-Exposure-Pixel CMOS Image Sensor for Multi-Exposure Single-Frame Computational Imaging," *In IEEE International Solid-State Circuits Conference (ISSCC 19)*, 2019.

PATENT

R. Genov, K. N. Kutulakos, N. Sarhangnejad, **R. Gulve**, H. Ke, "Method and System for Extending Image Dynamic Range Using Per-Pixel Coded Exposure," US Patent application 62/864,895, pending.

RESEARCH PROJECT OVERVIEW

The main goal is to study, design, and deploy a novel class of per-pixel coded-exposure computational cameras. The light falling on each pixel in the CEP cameras can be sorted into multiple collection sites based on the 1000-bit arbitrary exposure-code sequence per-pixel per-frame. I worked on many different aspects of the projects as follows:

Devices: Successfully optimized the performance of dual-tap global-shutter pixels for computational imaging.

Circuits: Designed a novel scalable regression-based flux-to-digital non-uniform quantization for image sensors using robust, reliable, and simple circuits such as comparators.

IC Systems: Designed the first of its-kind always-ON global-shutter coded-exposure image sensor.

Participated in (3) and led (6) multiple tapeouts with fellow research student teams.

CV Applications: Designed robust PCBs and APIs that enabled close collaboration with researchers from computer science at home and international universities (KAUST, CMU). Successfully implemented multiple new and existing computational imaging applications for HDR, 3D, machine-vision, vein, and multi-spectral imaging.

TECHNICAL SKILLS

IC Design: Analog, Digital and Mixed-Signal IC design, Pixel design, Top-level IC design & management

Programming: Verilog, Python (big-data, scripting, CV), C, C++ **Software:** Vivado, Virtuoso, Encounter, Innovus, Altium

Systems: PCB designing, Image sensors testing, Firmware, and API Development, 3D printing

Deployment: Active and passive computational imaging setups, Camera-projector alignment, and calibration

AWARDS AND RECOGNITIONS

- IWISS'22, Japan invited opening presentation based on the VLSI'22 paper Dec. 2022
- JSCC invited paper for a special issue as an extension of the VLSI'22 paper Aug. 2022
- CMC TEXPO 2021 Graduate Student Research Competition winner in micro-nanosystem design category Jan. 2021
- Best poster and demo award at International Conference on Computational Photography 2021, ICCP 2021 May 2021
- Research Expansion Grant (REG) recipient for interdisciplinary work Jul. 2020