Kunal **Chandan**

B.A.Sc Honours Electrical Engineering '23

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Libraries: Numpy, Pandas, PyTorch, Boost, FastAPI, Flask, CUDA

Languages: Python, C++, SQL, Verilog, VHDL, MATLAB, Go, RISC-V

Software: KiCAD, LTSpice, Cadence Virtuoso, LayoutEditor, Quartus Prime

Experience

POST-SILICON VALIDATION ENGINEER

NVIDIA - Contractor (6 months) — March 2024 - Present | Santa Clara, CA, USA

- Working on **PCIe** testing for upcoming SoCs and GPUs according to PCIe 5.0 spec

DATA SCIENCE RESEARCH ASSISTANT - AUTONOMOUS VEHICLES

University of Waterloo — Jan 2023 - Apr 2023 | Waterloo, ON, CA

- Fault analysis of autonomous vehicles (AVs), causality and failure modes of AVs explored, literature reviews conducted
- Causal inference and counterfactual reasoning applied to identify root cause failures
- Created a dashboard using **Flask/Dash** to allow for data exploration and identification of novel failure modes

SOFTWARE ENGINEER - FIRMWARE

Groq Inc. — Jan 2022 - Apr 2022 | Mountain View, CA, USA

- Defined algorithm for resource allocation over memory and processing units of tensors on Groq's TPU
- Developed **Python** and **C++** firmware API to improve streaming of instructions and data
- Used **PyBind11** for interoperability between C++ and Python firmware during codebase migration

SOFTWARE ENGINEER - DIGITAL COMPRESSION

Huawei Technologies — May 2020 - Aug 2020 | Waterloo, ON, CA

- Designed and analyzed non-cryptographic hash (NCHF) with linear algebra, SAT and self-designed $GF(2)$ matrix solver to verify properties
- Benchmarked the optimized SIMD hashing function against existing NCHFs (**Rust**, **C++**)
- Implemented novel border detection algorithm in **Go** using **probabilistic data structures** to maximize performance with Go-routines

ELECTRICAL ENGINEERING RESEARCH ASSISTANT - DISPLAY SEMICONDUCTORS

University of Waterloo — Sept 2022 - Apr 2023 | Waterloo, ON, CA

- Designed custom PCBs in **KiCAD** for driving small μLED active/passive matrix displays using **STM32** microcontroller and accompanying circuitry
- Developed research plan for packaging μLEDs onto TFT backplane using indium electroplating
- Designed characterization setups for μLEDs in **Fusion360** and **Arduino** interfaced with **Python**
- Validated flip-chip diebonding results with thermal and electrical simulations in **MATLAB**
- Designed and validated new μLED layouts to improve mechanical and electrical performance

Projects

C++ COMPILER FOR C++ LIKE LANGUAGE

- Wrote lexer and compiler to generate **RISC-V** assembly for custom programming language, used Spike-sim to verify correctness of assembly
- Used **CMake** (build management tool), **Catch** (unit-testing framework), **Boost** (graph library/dotviz generator)

MULTIPLE SEQUENCE ALIGNER

- Wrote sequence aligner for novo assembly of short sequences using Progressive Alignment Construction using the Needleman-Wunsch algorithm
- Written in **Go** to take advantage of light weight green threads, used greedy heuristics to reduce $O(n!)$ problem to $O(n^2)$

3D RAY TRACING ENGINE

- Implemented 3D recursive path-tracing for arbitrary materials on basic geometric shapes
- Used **nalgebra** for arbitrary rotations and positions of camera and objects
- Parallel processing of ray-tracing using **rayon** yielding **~10X** performance speed-up on CPU

PIPELINED RISC-V CORE

- Designed 5-stage pipelined **RISC-V** 32-bit core in **Verilog** using only synthesizable constructs
- Core synthesized on **FPGA** and successfully ran branching and recursive algorithms. Testbenches used to ensure cycle accuracy

BEAMFORMING HEARING AID SYSTEM

- Designed 4-channel microphone array PCB with active analog bandpass filtering, diff. amp., and multichannel **ADC** over **SPI** to R-Pi (**KiCAD**)
- Created **Flask** server on R-Pi to compress and transfer audio data to **Pytorch** neural network for further digital filtering and beamforming
- Adapted and trained Pytorch quantized voice isolation model to minimize latency while maintaining desired audio quality
- Used **multiprocessing**, **asyncio**, and **websockets** to maximize system throughput, providing continuous audio output

Education

UNIVERSITY OF WATERLOO – B.A.SC ELECTRICAL ENGINEERING '23

- Key Courses: Electronic devices, semiconductor physics, analog/digital integrated circuits, analog/digital/multivariable control systems
- Select Awards and Certifications: Baylis Medical Capstone Design Award, QNFCF and G2N Cleanroom Certifications