Kunal's **Portfolio**

University of Waterloo
B.A.Sc Honours Electrical & Computer Engineering

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Awards
— Baylis Medical Capstone Design Award
— NSERC Undergraduate Student Research Award

Certifications
— 2022 - QNFCF Cleanroom Certification
— 2022 - G2N Cleanroom Certification

Interests
— Cycling
— Rock Climbing
— Juggling

Hardware Projects

BEAMFORMING HEARING AID 🔗
— Designed 4 channel microphone array PCB in **KiCAD**, PCB does active analog bandpass filtering, differential amplification, and multichannel **ADC** over **SPI** to Raspberry Pi
— R-Pi does compression and sends audio over **Flask** server for further digital filtering and beamforming
— **Pytorch** to create quantized voice isolation model and minimize latency and maintain performance
— Used **multiprocessing**, **asyncio**, and **websockets** to maximize throughput and performance

REALIZABLE ANALOG FILTERS 🔗
— Generated optimal schematics and realizable parts for analog filter given cutoff frequency and roll-off
— Used **sympy** for circuit analysis and **pandas** as a parts database backend

Software Projects

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

MULTIPLE DNA SEQUENCE ALIGNER 🔗
— Perform multiple sequence alignement on DNA or amino acid sequences, **dynamic programming** and **graph theory** used to generate optimal sequence
— Used Go threads to improve performance, parallelization improved performance ???x

MANDELBROT GENERATOR 🔗
— Fractal generator written in **C++** using **CUDA**
— Parallleized code ran **56,160%** faster compared to single threaded CPU program