Kunal Chandan

B.A.Sc Honours Electrical Engineering Candidate

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LANGUAGES

- C++
- Rust
  - nalgebra
  - Rayon
- Python
  - Pandas
  - Numpy
  - Scipy
  - TensorFlow
  - Pytorch
  - OpenCV
- MATLAB
- Go
- SQL
- Verilog
- RISC-V
- Shell
- LaTeX

SOFTWARE

- Altium
- Proteus
- LTSpice
- KiCAD
- Quartus Prime
- Cadence
- LayoutEditor
- Linux
- Git

LAB SKILLS

- Wire-bonder
- Die-bonder
- Plasma Cleaner & Asher
- Dicing Saw
- HMDS Oven
- Probe Station
- Spincoater
- Wetbench
- PCB Design
- SEM
- X-Ray Spectroscopy

SUMMARY OF QUALIFICATIONS

- Multidisciplinary generalist electrical engineering skills specialist in software development at scale in data engineering with **Python** and performance critical development in **C++**
- Experienced research assistant with expertise in microfabrication, including developing research plans, layout designs, and hands-on lab-work
- Strong electrical engineering foundation through coursework in computer architecture, RF devices, controls, device physics, and IC design

EXPERIENCE

MICROFABRICATION RESEARCH ASSISTANT | University of Waterloo

Sep 2022 - Present | Waterloo, ON

- Developed research plan for advanced packaging of μLEDs onto TFT backplanes
- Developed indium electroplating setup, characterized using **SEM** and **EDX**, achieved reproducible high aspect ratio depositions with good electrical and mechanical properties
- Designed custom PCBs in **KiCAD** for driving small μLED active/passive matrix displays using **STM32** microcontroller and accompanying analog circuitry
- Validated flip-chip diebonding results with thermal simulations in **MATLAB**
- Created new layouts to improve mechanical and electrical performance

AUTONOMOUS VEHICLES RESEARCH ASSISTANT | University of Waterloo

Jan 2023 - Present | Waterloo, ON

- Causality and fault analysis of autonomous vehicles at the Control Learning & Logic Group
- Used **Carla, ROS 2, VerifAI, ScenicLang, AutowareAuto** to generate adversarial scenario data
- Identified points of failure in perception, motion planning and drive controllers to place fault using causal analysis

SOFTWARE DEVELOPER | Groq Inc.

Jan 2022 - April 2022 | Mountain View, CA, USA

- Defined resource allocation over memory & processing units of tensors on Groq's TPU
- Developed **Python** & **C++** API to improve streaming of instructions & data
- Used **PyBind11** for interoperability of **C++** & **Python** API for compilation performance
- Used timing analysis to prevent stream conflicts & allowed for interleaving of streams

DIGITAL COMPRESSION RESEARCH ANALYST | Huawei Technologies

May 2020 - Aug 2020 | Waterloo, ON

- Designed collision free non-cryptographic hash function (NCHF) in Galois Field 2
- Analyzed NCHF with linear algebra, SAT & 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

MACHINE LEARNING DEVELOPER | MappedIn

Sept 2019 - Dec 2019 | Waterloo, ON

- Designed data pipelines for cleaning & analysis; integrated new **SQL** data warehouse
- Increased prediction accuracy from **40%** to **80%** on existing **LSTM** models with feature engineering, hyperparameter optimization, & automated data cleaning (**Python** + **SQL**)
- Created **Embeddings** + **SVM** + **Random Forest** ensemble models to replace existing **LSTM** models, reducing inference costs **2X** while maintaining prediction accuracy

SOFTWARE DEV. - BIOINFORMATICS | Ontario Inst. for Cancer Research
Jan 2019 - April 2019 | Toronto, ON

- Project lead of new statistical analysis tool for all future studies at OICR-GSI
- Designed genomics pipelines for visualization, cleaning, and analysis; interfacing with existing **R**, **Perl**, and **Shell** pipelines
- Wrote future-proof and extensible code to process big datasets (**Pandas** + **Shell**)
- Open-sourced project and version controlled with **Git**; created extensive documentation

SOFTWARE DEV. - BIOINFORMATICS | Robarts Research Institute
Jan 2021 - April 2021 | London, ON

- Developed software in **Python** & **SQL** for existing genetics analysis pipeline
- Resolved bugs in existing lab software (**Perl**, **Python**, **C#**)
- Developed software for migration of genetic analysis database from GRCh37 to GRCh38

PROJECTS

PIPELINED RISC-V CORE

- Designed 5-stage pipelined **RISC-V** 32-bit core in **Verilog**
- Optimized the performance of the processor through techniques such as pipeline design and hazard prevention minimizing stalling
- Core synthesizable on FPGA and successfully run simple programs, used testbenches to ensure cycle accuracy

MACHINE LEARNING BEAMFORMING HEARING-AID

- Designed analog filters using active circuits for bandpassing human voice
- designed multichannel microphone array to pass analog data over **USB-HS** on custom PCB designed in **KiCAD**
- Improved ML models for real-time beamforming and voice isolation, inference time improved **3x** while maintaining performance
- Used **Pytorch** to create quantized voice isolation model hyperparameter optimization used to minimize latency while maintaining performance
- Used **multiprocessing** and **asyncio** to maximize throughput and run **Flask** server

RAY TRACING ENGINE

- Implemented 3D recursive ray tracing engine for arbitrary materials on spheres in **Rust**
- Used traits & modular programming to create extensible scene-object interface
- Used **nalgebra** for arbitrary rotations & positions of camera & objects
- Parallel processing of ray-tracing using **rayon** yielding **2X** performance speed-up

OTHERS

- Kinematics & electrodynamics engine written in **C++** used trees to maximize performance
- 2D Lattice-Boltzmann fluid dynamics solver written in **Rust** using **Piston**
- WaterlooWorks and OscarPlus (McMaster) job crawler written with **Selenium**
- Webcrawler for scraping comics from KissComics, circumvented Google Captcha

EDUCATION

UNIVERSITY OF WATERLOO
B.ASc Electrical Engineering Candidate Class of 2023

RELEVANT COURSES

- Computer Architecture
- Electronic Devices, Semiconductor Physics, Analog/Digital Integrated Circuits
- Analog/Digital/Multivariable Control Systems
- Radio Frequency & Microwave Circuits

AWARDS & CERTIFICATIONS

2022 Baylis Medical Capstone Design Award
2022 University of Waterloo Quantum Nano Fab Centre for Fabrication Cleanroom Certification
2022 University of Waterloo Giga 2 Nanoelectronics Cleanroom Certification

CLUBS

Juggling Club
Cycling Club
Rock Climbing Club
IEEE Packaging Soc.
EngPlay Actor
Eng. Ambassador
Eng. Orientation Leader

INTERESTS

- Cycling
- Rock Climbing
- Juggling