Kunal Chandan

B.A.Sc Honours Electrical Engineering Candidate

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LANGUAGES

- C++
- Rust
  - Piston
  - nalgebra
  - rayon
- Python
  - Pandas
  - Numpy
  - Scipy
  - TensorFlow
  - OpenCV
  - Selenium
- MATLAB
- 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

SUMMARY OF QUALIFICATIONS

- Strong data engineering experience from leading projects at Robarts, MappedIn, & OICR
- Excellent data pipeline experience in **Python**, **SQL**, & **Shell** at Robarts, MappedIn, & OICR
- Understanding of **Verilog** & **RISC-V** from coursework involving computer architecture & hardware design
- Strong electrical hardware design skills at device level fabrication experience and design with Cadence
- Circuit-board design experience from internship and projects using KiCAD

EXPERIENCE

MICROFABRICATION RESEARCH ASSISTANT | University of Waterloo

Sep 2022 - Present | Waterloo, ON

- Developed research plan for advanced packaging of μLEDs onto TFT backplanes
- Developed custom indium electroplating setup and validated fabrication results with SEM
- Designed custom PCBs in KiCAD for driving small μLED displays using STM32 microcontrollers
- Validated flip-chip diebonding results with thermal simulations in MATLAB
- Developed layouts to optimize existing designs for improved mechanical and electrical performance

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 | 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

SOFTWARE DEV. - BIOINFORMATICS | Ontario Institute 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

PROJECTS

PIPELINED RISC-V CORE

- Designed 5-stage pipelined RISC-V 32-bit core in Verilog
- Implemented pipelined datapath and handled control and data hazards to minimize stalling
- Core able to run complete programs and synthesized on FPGA

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 5x while maintaining performance

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

PHYSICS ENGINE

- Implemented kinematics & electrodynamics written with **Allegro5** & **C++**
- Implemented quadtrees for increased performance from reduced collision checks & fewer negligible force calculations by **pruning** tree

OTHERS

- 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

2022 Baylis Medical Capstone Design Award

CLUBS

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

INTERESTS

- Cycling
- Rock Climbing
- Juggling