Hanson Sun

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Technical Skills

Languages: C, C++, Python, JavaScript, Java, HTML/CSS, R, C#, Bash, LaTeX, Julia
Frameworks/Libraries: QT/QML, AWS, PyTorch, Jupyter, Django, Node.js, Scikit-learn, NumPy, TensorFlow
Tools: Git, Docker, Linux, Valgrind, MPLAB, GDB, GPROF, WSL, CMake, Unity, Hugging Face, Arduino

Experience

Embedded Software Engineer Jan. 2024 – Aug. 2024
NZ Technologies *Vancouver, BC*

- Led redesign of touchless medical device: front-end (**QT/QML**), firmware (**C**), API middleware (**C++**).
- Designed a **configurable** and **stateful** data-representation/serialization system for **code-free** customization.
- Created a **cross-compiled** C++ build system with **Docker** and **CMake**, resulting in **10x** faster build times.
- Pioneered a **CI/CD pipeline** with **automated scripts**, **regression tests**, and **software release procedures**.
- Implemented **Kalman filters** and 3D **gesture algorithms**, increasing accuracy by **50%** and speed to **400FPS**.
- Developed a **multi-device**, **event-driven IP** communication scheme using **UDP**, **congestion control**, **connection management**, with a **TCP-based FTP**; achieved **98%** FTP accuracy and **40%** performance gain.
- Integrated with hardware by using **I2C** for Teensy **HID** control and **SPI** for IMU and 3D capacitive sensors.

Data Engineer Research Assistant Nov. 2023 – Jun. 2024
Pacific Laboratory for Artificial Intelligence (PLAI) *Vancouver, BC*

- Spearheaded a data-processing pipeline for **200TB** of Minecraft data with **image** and **audio processing**.
- Leveraged **Python** and the **Whisper ASR** model to produce time-stamped transcripts with **4x** real-time speed.
- Designed Dataloaders/Datasets in **PyTorch**, integrating **variational autoencoders** to improve model training.
- Integrated the data-processing pipeline with **AWS S3**, **DynamoDB**, using **AWS EC2**.

Undergraduate Teaching Assistant Aug. 2023 – Dec. 2023, Sep. 2024 - Present
University of British Columbia *Vancouver, BC*

- Instructed tutorial and lab sessions for CPSC 121 (Discrete Math and Circuits) and CPSC 213 (Computer Systems)

Projects

Poshchure (Stormhacks 2024 winner) | *React, C++, Python, Flask, scikit-learn, cv2, MediaPipe, Kintone DB*

- **Fullstack** posture monitoring product with **computer vision, ML, data analytics,** and **wearable hardware**.
- Built an MVP using **React** and **Flask**, integrating an **ESP8266** wearable with **C++** and **UDP** networking.
- Analyzed video-stream features with **cv2** & **MediaPipe**, training a **sklearn** model with **90% accuracy** at **30FPS**.

MindVault | *Python, SQL, HuggingFace, LangChain, SQLite, Numpy, Docker*

- **Dockerized** knowledge database and **RAG agent** as a study aid for notes, served with a **REST API**.
- Implemented a custom **vector search database** using **FAISS** & **SQLite** with **bi-encoder** support and **trigram BM25 search**; achieving **10x** faster indexing and a **50%** smaller storage footprint than **sqlite-vss**.
- Developed a **RAG** agent with **CoT prompting** and **cross-encoder re-ranking**, improving retrieval by **40%**.
- Devised a **file tracking system** (similar to **git**) to automate database indexing for new, edited, and deleted files.

Particle Physics 2D (PPhys2D) | *JavaScript, Webpack, Node.js, JsDoc*

- An interactive web-based **particle-physics** engine supporting collision, constrained, and fluid dynamics.
- Developed a components system with an **OOP**-based **API**, providing convenient abstractions and extensibility.
- Achieved **>60 fps** with **50,000+** particles, and improved simulation stability using **spatial partitioning**, **numerical discretization**, and hybrid **impulse-position-based** algorithms.

C++ Feed-forward Neural Network | *C++, Valgrind, GDB, GPROF*

- Constructed a **multi-layer neural network** and a matrix library, benchmarked with MNIST classification.
- Utilized **thread-pools**, **vectorization**, and **cache-efficient** data processing to improve performance by **30x**.
- Increased convergence with an accuracy of **89%** by implementing **cross-entropy cost**, **hybrid hidden layers**, etc.

Education

University of British Columbia Vancouver, BC
3rd year, Bachelor of Science in Honours Computer Science, Minor in Data Science *2022 – 2026*

- 95% Average, Science Scholar, Dean's List, Trek Excellence Scholarship, J Fred Muir Memorial Scholarship