Hanson Sun

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Technical Skills

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

Experience

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

- Led the **re-design** and implementation of a touchless medical device, from user-end software (**QT/QML**), microcontroller firmware (**C**), and API middleware (**C++**).
- Developed a **configurable**, **serializable**, and **stateful** data-representation system allowing idiomatic behaviour customization **without code**; received **positive** stakeholder feedback.
- Created a **cross-compilation** C++ build system with **Docker** and **CMake**, resulting in **10x** faster build times.
- Implemented **Kalman filters** and 3D **gesture detection algorithms** utilizing **computational linear algebra** and **discrete calculus**, increasing accuracy by **50%** and performance to **400FPS**.
- Designed **UDP** and **FTP** networking protocols, reducing communication latency by **40%** and drop rates by **60%**.

Data Engineer Research Assistant (Volunteer) Nov. 2023 – Present
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.
- Currently enhancing cloud integration for the data pipeline using **AWS S3**, **DynamoDB**, and **AWS EC2**.

Undergraduate Teaching Assistant Aug 2023 – Dec 2023
University of British Columbia *Vancouver, BC*

- Instructed tutorial and lab sessions for ∼**100** students, fostering discussions and addressing questions.

Projects

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

- **Dockerized** local database and RAG agent for personal notes for accelerated learning and studying.
- Implemented a custom **vector search database** with **FAISS** and **sqlite** that runs **10x** faster with a **50%** smaller storage footprint compared to **sqlite-vss**.
- Developed a **RAG** chain with **CoT prompting** and an **LLM-powered** retrieval system using **LangChain**.

Managalator (nwHacks 2024) | *React, JavaScript, Python, MongoDB, FastAPI, DeepL, cv2, pillow*

- ML-powered manga translation and localization **MVC** web application for small manga artists.
- Implemented a **React** front-end with a REST API **Python** back-end with **FastAPI** and **MongoDB**.
- Utilized a pre-trained **ML model** for image segmentation, the **DeepL** API for translation, and **cv2** for text infill.

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

- Designed a web-based **particle-physics** engine that supports constrained and fluid dynamics.
- Developed an **OOP**-based **API**, providing end-user abstraction 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 accuracy of **89%** by implementing **cross-entropy cost**, **hybrid hidden layers**, etc.

Education

University of British Columbia Vancouver, BC
2nd year, Bachelor of Science in Honours Computer Science, Minor in Data Science *2022 – 2027*

- 96.4% Average, Science Scholar, Dean's List, Trek Excellence Scholarship, J Fred Muir Memorial Scholarship