

Emilien Breton

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— EXPERIENCE —

EcoSafeSense

FIRMWARE ENGINEER Ottawa | October 2024–Present

- Writing firmware for ESP32-based air quality sensor and complementary test bench.

Cohere

SENIOR DATA QUALITY SPECIALIST — ADVANCED MATHEMATICS Freelance | October 2024–April 2025

- Wrote, audited and corrected LLM prompts and responses to produce **spotless training data** in formal logic, combinatorics, number theory, graph theory and mathematical optimization.

— PROJECTS —

DFA Regex Engine

- Built regex engine in C99 that compiles regular expressions down to minimal deterministic finite automata to match input strings in **linear time** without backtracking.
- Wrote extensive test suite of over **500 tests** to ensure end-to-end correctness of engine and catch regressions.
- Developed grep-like tool as real-world stress test for engine and achieved performance on par with GNU grep.

Breadboard Microcomputer

- Designed 8-bit microcomputer from from logic gates upward, including instruction set architecture, from-scratch assembler and cross-platform emulator in Rust, totaling over **20 000 SLOC** and **750 hours** of work.
- Wrote various utilities in Assembly running natively on microcomputer — Wozmon-inspired memory monitor • 16×16 sprite editor • Tetris clone • native assembler • postfix notation calculator.
- Built microcomputer in hardware by hand-wiring discrete 74HC-series logic chips on breadboards.

Rudimentary C Compiler

- Building C99 compiler from scratch in Rust targeting breadboard microcomputer’s instruction set.
- Implemented dead code elimination, constant folding and strength reduction, resulting in **20% increase** in generated code performance and **10% reduction** in binary size across test suite.
- Developed extensive C standard library, including heap allocator supporting **malloc and free**, string handling functions such as **strlen and memcpy** and input/output routines including **getline and printf**.

Multilayer Perceptron

- Wrote static reverse-mode automatic differentiation library in C99 for use in deep learning.
- Designed multilayer perceptron model and implemented stochastic gradient descent, momentum and L2 regularization, achieving **97% accuracy** on MNIST database after 3 minutes training on 16 threads.

— VOLUNTEERING —

Computer Science Club

CLUB EXECUTIVE University of Ottawa | June 2022–Present

- Running growing community of **over 1500** computer science students at the University of Ottawa.
- Collaborating with executive board to brainstorm, plan, fund and market monthly events and meetups, such as workshop on Vim bindings and mini-course on the λ -calculus.

Hack the Hill Hackathon

DEVELOPMENT MANAGER — DEVELOPMENT TEAM Ottawa | November 2022–October 2024

- Led development of open-source event management system based on Next.js and Prisma and used by over **1000 hackers** and **50 organizers** throughout hackathon.
- Built and maintained internal payment portal powered by Stripe and React.js in collaboration with sponsorship team that processed upwards of **20 000\$**.

— AWARDS —

• AIT Hackathon 3.0 — 1st place, Mocha challenge	September 2025
• uOCTF 2025 — 1st place	March 2025
• uOttaHack 6 — 1st place, QNX challenge	January 2025
• CS Games 2024 — 1st place, IOT challenge	March 2024
• uOCTF 2024 — 1st place	November 2023
• DeFi The Conventional — 1st place, DeFi challenge	March 2022

— SKILLS —

- **Languages** — C • Rust • Python • Haskell • JavaScript
- **Tools** — GNU/Linux • GDB • GNU Make • Vim • Docker • React

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