Emilien Breton

613-913-9909 • mail@emilien.ca • github.com/Bricktech2000 • linkedin.com/in/emilien-breton • https://emilien.ca/

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 with utmost attention to detail to produce **spotless training data** in formal logic, combinatorics, number theory, graph theory and 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 **400 tests** to ensure end-to-end correctness of engine and catch regressions.
- Developed grep-like tool as real-world stress test for engine, achieving 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, enabling processing of over **20 000$**.

AWARDS

- **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 • C++ • JavaScript • HTML/CSS • JSON • YAML • Markdown • LaTeX • Lua
- **Developer Tools** — GNU/Linux • Vim • Bash • Fish Shell • Git • GDB • GNU Make • Docker
- **Other Technologies** — React • Node.js • Express • Figma • Notion • Cloudflare • GitHub

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