# BEN MORCOS

full(er) stack developer

**SOFTWARE** · **EMBEDDED** · **AI/ML** · **SYSTEM DESIGN** · **HARDWARE**


## CONTACT

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## LANGUAGES

English, French

## PROGRAMMING

Python, C/C++, Go
OpenCL, CUDA
VHDL, Verilog, HLS
JavaScript, TypeScript
LaTeX, shell, Tcl, Make

## TOOLS

Git, AWS
Docker, Kubernetes
Rest, GraphQL
TravisCI, Codecov
Jenkins, Harness
pytest, GTest
TensorFlow, TFMOT
NNI, Hyperopt
Vivado, Quartus
MATLAB, Simulink

## OPEN IP

zynq-axi-dna
c5soc-ocl-id
pre-commit-hooks-cpp
discord-downloader

**CONTRIBUTOR**

nengo
nengo-fpga

## HOBBIES

Hiking & Canoeing
Climbing
Woodworking
Music
Cooking
Various sports
Philosophy

## ABOUT ME

My academic and work experience has given me development skills at many levels of abstraction. I have worked on everything from gate-level hardware to embedded software to frontend clients, and everything in between. This breadth of knowledge led me to the label *full(er) stack developer* and I appreciate the perspective this affords me when designing systems and working across teams. I'm always looking to hone my skills and continue to learn new things. However, I am currently most interested in the middle of the full(er) stack from embedded to core application to backend.

## WORK EXPERIENCE

2022–Now **Arctic Wolf** *Waterloo, ON*
*Developer - platform/asset-management*
- Develop and maintain high volume services as part of the mission critical 24/7 data pipeline.
- Personally improve endpoint performance by 2× within first few weeks of employment.
- Optimize workflow and reduce pain points by creating new test and build infrastructure.
- Champion code best practices to improve maintainability.

2016–2022 **Applied Brain Research** *Waterloo, ON*
*Neuromorphic Software-Hardware Co-Developer*
- Explore, optimize, and implement neural applications on various standard, embedded, and neuromorphic hardware platforms.
- Establish a common high-level interface, via GUIs and APIs, for deploying neural networks across various hardware platforms.
- Provide low-level libraries, interfaces, and protocols for modular embedded neural deployments.
- Bring to market edge AI web platform.
- Devise AI/ML solutions and benchmarking for dynamical tasks.
- Leverage model pruning and quantization techniques.
- Collaborate with leading scientists pushing the boundaries of computational neuroscience applications including autonomy, vision, speech, and more.
- Single handedly develop run-time flexible FPGA design to efficiently run dynamic neural networks with a user-friendly interface.
- Manage and mentor co-op and Mitacs students.

2014–2015 **Teledyne DALSA** (co-op ×2) *Waterloo, ON*
*Mechanical Designer*, *Sustaining Engineer*
- Designed and validated custom fixtures for testing and production.
- Optimized and debugged software and hardware of vision sensors.

2014 **Toyota Motor Manufacturing Canada** (co-op) *Cambridge, ON*
*Quality Control Engineer for Lexus Hybrid group*
- Performed root cause analysis and coordinated trial solutions.

2013 **Intellijoint Surgical** *formerly Avenir Medical* (co-op) *Waterloo, ON*
*Medical Device Designer*
- Implemented and evaluated optical feature extraction algorithms.

2012–2013 **IKO Industries** (co-op ×2) *Madoc, ON*
*Mechanical Engineer*, *Electrical & Systems Engineer*
- Improved throughput by 13% with analysis and recommendation.
- Optimized sensors, PLC, and HMI.

# EDUCATION

2017–2019 **MASc** — Computer Hardware Engineering
*The University of Waterloo*
Developed a neuromorphic hardware accelerator on FPGAs with a focus on run-time flexibility and accessibility. The hardware is conveniently connected to Python via the Nengo development framework and is run-time configurable to support a wide range of neural networks with a static hardware design.

2011–2016 **BASc** — Mechatronics Engineering, with distinction
*The University of Waterloo*
The Mechatronics program covers a broad base of mechanical, electrical, computer, and system design engineering while my elective courses leaned towards philosophy, machine intelligence, and neuroscience. My capstone design project was a small-scale portable hydro-electric generator built from scratch.

# PUBLICATIONS

Peter Blouw, Gurshaant Malik, **Benjamin Morcos**, Aaron R. Voelker, and Chris Eliasmith (2021). *Hardware Aware Training for Efficient Keyword Spotting on General Purpose and Specialized Hardware*
*TinyML Research Symposium*

**Benjamin Morcos**. NengoFPGA: an FPGA Backend for the Nengo Neural Simulator. MASc thesis. University of Waterloo, 2019. URL: http://hdl.handle.net/10012/14923.

**Benjamin Morcos**, Terrence C Stewart, Chris Eliasmith, and Nachiket Kapre (2018). *Implementing NEF Neural Networks on Embedded FPGAs*
*International Conference on Field-Programmable Technology (FPT)*, Naha, Okinawa, Japan

# VOLUNTEER WORK

2017–Now **The Foodbank of Waterloo Region** *Kitchener, ON*
Work at the distribution warehouse to sort food and keep track of local inventory. This is a fun, low mental effort, and social position that benefits the community — everybody wins!

2017 **Teaching Assistant** *Heterogeneous Architecture Summer School*
Assisted with a one week workshop teaching students about computation using heterogeneous hardware platforms (FPGA, GPU, CPU).

2014–2015 **Federation Orientation Committee** *The University of Waterloo*
One of four volunteers responsible for planning Engineering Orientation Week 2015 for ≈2000 incoming students:
- Interviewed, hired, and managed a team of ≈400 volunteers.
- Obtained sponsorship and created a formal budget for the year.
- Worked alongside numerous other entities within the University.
- Kept well documented records for continuous improvement.