

# BenMorcos

curious neuromorphic engineer

## CONTACT

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github.com/bmorcos

## LANGUAGES

English  
French

## PROGRAMMING

Python  
C, C++  
OpenCL, CUDA  
VHDL, Verilog, HLS  
L<sup>A</sup>T<sub>E</sub>X, shell, Tcl  
VBA

## TOOLS

GitHub, GitLab, TravisCI  
pytest, GTest  
Vivado, Quartus  
AutoCAD, SolidWorks  
MATLAB, Simulink  
kdenlive (video editing)

## OPEN IP

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

## HOBBIES

Hiking & Canoeing  
Climbing  
Woodworking  
Music  
Cooking  
Various sports  
Reading

## ABOUT ME

My BAsc in Mechatronics Engineering gave me a broad foundation of skills which allowed me to explore a variety of fields. However, developing hardware in the context of neuroscience has me especially engaged and excited. Furthermore, working with a plethora of leading PhD scientists allows me to learn everyday and motivated me to pursue a master's degree.

## EDUCATION

2017–2019 **MAsc** — Computer Hardware Engineering

*The University of Waterloo*

Working with FPGAs to develop *neuromorphic* hardware to accelerate neural network computation with focus on flexibility and ease-of-use. The hardware is accessible by Python via the Nengo development framework and has run-time reconfigurability 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.

## WORK EXPERIENCE

2016–Now **Applied Brain Research**

*Waterloo, ON*

*Neuromorphic Engineer & Lead Hardware Developer*

- Design flexible FPGA implementations to efficiently run dynamic neural networks.
- Maintaining a user-friendly interface layer between the FPGA and Python by extending the Nengo framework.
- Working in collaboration with leading scientists on neuro-robotics and various other computational neuroscience applications.
- Assisting with yearly *Nengo Summer School* — a two week in-depth workshop for international scholars to learn and use Nengo.

2014–2015 **Teledyne DALSA** (co-op)

*Waterloo, ON*

*Mechanical Designer*

- Custom fixture designs starting with constraints and criteria and following through to vendor bids, manufacturing, and validation.
- Sustaining Engineer*
- Optimizing and troubleshooting software and hardware by recreating manufacturing observations in a lab environment.

2014 **Toyota Motor Manufacturing Canada** (co-op)

*Cambridge, ON*

*Quality Control Engineer for Lexus Hybrid group*

- Design of experiments to discover root cause as well as custom design and implementation of toolings to improve consistency.
- Coordinating interdepartmental operations and started new initiative to relate internal KPIs to user experience.

- 2013 **Intellijoint Surgical** formerly Avenir Medical (co-op) *Waterloo, ON*  
*Medical Device Designer*
- Algorithm design and analysis, including test case development, with focus on image processing and feature extraction.
  - Rapid prototyping of mechanical parts.
- 2012–2013 **IKO Industries** (co-op) *Madoc, ON*  
*Mechanical Engineer*
- Improved throughput by 13% with analysis and recommendation.
  - Helped organize and analyze full process audit.
- Electrical & Systems Engineer*
- Optimized sensors, PLC, and HMI to save man-hours and improve consistency.
  - Created a user-friendly database to track plant KPIs.

## PUBLICATIONS

**Benjamin Morcos.** *NengoFPGA: an FPGA Backend for the Nengo Neural Simulator*. MASc thesis. 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*  
 Assisting 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*  
 Assist with a one week workshop teaching students about computation using heterogeneous 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  $\approx 2000$  incoming students:
- Interview, hire, and manage a team of  $\approx 400$  volunteers.
  - Obtain sponsorship and create a formal budget for the year.
  - Work alongside numerous other entities within the University.
  - Keep well documented records for continuous improvement.
- 2011–2015 **Campus Response Team** *The University of Waterloo*  
 Providing emergency first-aid for on-campus events.
- Operations Coordinator* — 2014
- Manage and improve day-to-day and event operations.
- Director of Training* — 2012–2013
- Organize weekly training and termly first-aid competition.

## CERTIFICATIONS & AWARDS

- 2009–Now **Advanced Medical First Responder**  
*Canadian Ski Patrol System & St. John Ambulance*  
 I used to volunteer as a ski patrol at Mt. Tremblant, QC and then I was a member of the Campus Response Team during my undergrad. I no longer actively provide first-aid but I still maintain my certification!
- 2013 **NSERC Industrial Undergraduate Student Research Award** *Intellijoint Surgical*
- 2012 **Nominated as Co-op Student of the Year** *The University of Waterloo*
- 2011 **President's Scholarship** *The University of Waterloo*