BenMorcos

curious neuromorphic engineer

CONTACT

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LANGUAGES

English
French

PROGRAMMING

Python
C, C++
OpenCL, CUDA
VHDL, Verilog, HLS
LaTeX, shell, Tcl
VBA

TOOLS

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

OPEN IP

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

HOBBIES

Hiking & Canoeing
Climbing
Woodworking
Music
Cooking
Various sports
Philosophy

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. After completing my master's degree I continue to learn everyday as I work with a plethora of leading PhD scientists!

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 Software-Hardware Co-Developer
- Explore, optimize, and map neural applications to various hardware backends.
- Design flexible FPGA implementations to efficiently run dynamic neural networks with a user-friendly Python interface.
- 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

Peter Blouw, Gurshaant Malik, **Benjamin Morcos**, Aaron R. Voelker, and Chris Eliasmith. Hardware Aware Training for Efficient Keyword Spotting on General Purpose and Specialized Hardware. 2020. arXiv: 2009.04465.

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 ≈2000 incoming students:
- Interview, hire, and manage a team of ≈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

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*