FABRIZIO OTTATI

Digital hardware design for deep learning

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RESEARCH INTERESTS

In my doctorate, I am focusing on the acceleration of **deep learning** models inference on digital hardware, with emphasis on **FPGA** platforms. In particular, I analyze spiking neural networks and their application to event-based vision, i.e. data generated by **event cameras** (see this link from Sony). In my research, I employ and study **high-level synthesis** tools to translate C++ descriptions to RTL. Recently, I also started to investigate the optimization passes in **compilers**, to maximize performance (latency or throughput) and/or minimize resource usage on FPGAs. My main areas of interest are:

- event-based vision.
- deep learning.
- digital hardware design, abstractions and automation: EDA, compilers, HLS, reconfigurable accelerators.
- computer science.
- efficient mapping of algorithms to domain-specific hardware (FPGAs, ASIC accelerators for deep learning, SoCs, chiplets).

EXPERIENCE

Visiting researcher

Cognitive systems and nodes - Professor Charlotte Frenkel

Feb 2023 - Sep 2023 Delft University of Technology

Design of an FPGA accelerator for the neuromorphic controller of an autonomous drone, in collaboration with MAVLab, led by Professor Guido De Croon. I have developed an FPGA accelerator to run a spiking CNN interfaced with an event camera, tailoring the architecture to the drone power budget (<300 mW) and payload capacity (the drone weighs 27 g). I have also directed the re-design of the network, with the help of Jesse Hagenaars, a Ph.D. student supervised by Professor de Croon, optimizing the neuron model to minimize the memory footprint of the network while preserving performance (in our case, the optical flow estimation precision).

PUBLICATIONS

- *To Spike or Not To Spike: A Digital Hardware Perspective on Deep Learning Acceleration*, Fabrizio Ottati et al., ArXiv, 2023.
- *NeuroBench: Advancing Neuromorphic Computing through Collaborative, Fair and Representative Benchmarking*, Jason Yik et al., ArXiv, 2023.
- *Custom Memory Design for Logic-in-Memory: Drawbacks and Improvements over Conventional Memories*, Fabrizio Ottati et al., ArXiv, 2021.

SKILLS

Deep learning · PyTorch · Git · C/C++ · Unix · FPGA · Design automation · Computer architecture · High-level synthesis

LANGUAGES

Italian ● ● ● ● ●
Mother tongue

English ● ● ● ● ○

EDUCATION

Ph.D. in Electronics and Telecommunications Engineering

Politecnico di Torino

Nov 2020 - Feb 2024

M.Sc. in Electronic Engineering, Microelectronics

Politecnico di Torino

Oct 2017 - Apr 2020

Grade: 110/110 cum laude.
GPA: 29.6/30.

B.Sc. in Electronic Engineering

Politecnico di Torino

Oct 2014 - Oct 2017

Grade: 108/110.
GPA: 27.93/30.