LUCA URBINATI

Electronic Engineer
PhD Fellow

13/02/1995
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Driving licence: B
Italian: native language
English: B2 IELTS 2017

Personal Interests

I am passionate about travel, photography and digital marketing. I love cycling and sailing. I like food, watching dystopian movies, and playing board games.

Education

POLITECNICO DI TORINO
PhD in Hardware Accelerators for Deep Learning · 2020-Now

POLITECNICO DI TORINO
Electronic Engineering: Electronic Systems · 110/110 · 2017-2019

LINKÖPING UNIVERSITET
European Union Programme ERASMUS+ · 2016-2017 (5 months)

UNIVERSITY OF BOLOGNA (CESENA HEADQUARTER)
Electronic Engineering for Energy and Information · 109/110 · 2014-2017

Work experience

NOW - MAY 2020

PHD STUDENT AT POLITECNICO DI TORINO

- **Digital Hardware Designer of Deep Learning accelerators and precision-scalable multipliers**

Skills: High-Level synthesis (Catapult HLS, C language), Design and simulation of RTL and gate-level digital circuits (VHDL, QuestaSim), Logic synthesis (Design Compiler), Scripting (Python, Bash, TLC), Versioning (GitHub), Linux environment, Time management.

- **End-to-end Machine-Learning projects**

Skills: Data collection, Data pre-processing (Scikit-Learn), Model training (TensorFlow, Keras), Hyper-parameters tuning (Bayesian Optimization), Quantization (QKeras), Pruning, Inference on microcontrollers or FPGAs (TFLite/LiteMicro, Vivado).

- **Author and co-author of 10+ scientific papers**

Skills: Scientific paper writing (LaTex, Draw.io, Gnuplot), Analytical & synthesis skills, Team working.

- **Presenter at 5 national/international conferences**

Skills: Slide and poster creation (Power Point, Prezi), Public speaking, Networking.

- **Co-supervisor of 7+ Master's thesis students**

Skills: Linux administration (e.g. accounts, lxc containers) and software installation (e.g. pip, conda), Project management (define students' activities and deadlines).

- **Lab assistant for the Microelectronics Course held by Prof. Casu.**

Skills: Simulations and layout of simple digital circuits, DRC and LVS (Cadence Virtuoso).

Other Soft Skills

- Autonomy & Team Working
- International Spirit
- Friendly
- Open-minded & Curious
- Problem Solving
- Meticulous
- Continuous Learning
- Public Speaking

Main Pubblications

JUN 2023 — **DESIGN-SPACE EXPLORATION OF MIXED-PRECISION DNN ACCELERATORS BASED ON SUM-TOGETHER MULTIPLIERS**
Urbinati L. and Casu M.R., in Proc. of 2023 International Conference on PhD Research in Microelectronics and Electronics (PRIME), pp. 377–38, IEEE, Valencia (Spain).

NOV 2022 — **A RECONFIGURABLE DEPTH-WISE CONVOLUTION MODULE FOR HETEROGENEOUSLY QUANTIZED DNNS**
Urbinati L. and Casu M.R., in Proc. of 2022 IEEE International Symposium on Circuits and Systems (ISCAS), Austin, (TX, USA).

SEP 2022 — **A RECONFIGURABLE MULTIPLIER/DOT-PRODUCT UNIT FOR PRECISION-SCALABLE DEEP LEARNING APPLICATIONS**
Urbinati L. and Casu M.R., in Proc. of 2022 Annual Meeting of the Italian Electronics Society (SIE), pp. 9–14, Springer, Pizzo (Italy).

JUL 2021 — **MACHINE-LEARNING-BASED MICROWAVE SENSING: A CASE STUDY FOR THE FOOD INDUSTRY**
Ricci M., et al., in IEEE Journal on Emerging and Selected Topics in Circuits and Systems (JETCAS), 11(3), pp. 503–514.

OCT 2020 — **A MACHINE-LEARNING BASED MICROWAVE SENSING APPROACH TO FOOD CONTAMINANT DETECTION**
Urbinati L. et al., in Proc. of 2020 IEEE International Symposium on Circuits and Systems (ISCAS), pp. 1–5, Seville (Spain).

Main Courses

PARALLEL AND DISTRIBUTED COMPUTING

25 hours · PhD School of Politecnico di Torino · Prof. Savino · Jul 2021

- Classification of parallel and distributed computers: SIMD (GPUs, Vector processors) and MIMD (Multi-core processors, Clusters).
- Amdahl's law.
- Multithreading, Message passing Interface (MPI), OpenMP.
- Profiler.
- PCI, PCI-Express, Infiniband.

BIG DATA PROCESSING AND PROGRAMMING

20 hours · PhD School of Politecnico di Torino · Prof. Trevisan · Mar 2021

- Introduction to Big data: characteristics, problems, opportunities.
- Hadoop: infrastructure and basic components.
- Apache Spark Architecture.
- Spark RDD programming.
- Spark DataFrame programming.
- Lab on developing applications by means of Spark using Python.

OPERATING SYSTEMS

60 hours · Master's course of Politecnico di Torino · Prof. Rebaudengo · Jun 2019

- Operating system architecture.
- Processes and Threads.
- Process synchronization: mutex, condition variables, semaphores, message passing.

STRUCTURING MACHINE LEARNING PROJECTS

6 hours · DeepLearning.AI on Coursera.org · Instructors: Andrew Ng, Younes Bensouda Mourri, Kian Katanforoosh · Mar 2021 · Certificate.

- How to split data in Train/Dev/Test distributions, and size Dev and Test sets.
- Which evaluation metrics to use
- Error analysis.

LEAN STARTUP E LEAN BUSINESS FOR L'INNOVATION MANAGEMENT

20 hours · PhD School of Politecnico di Torino · Prof. Perboli · Jul 2021.

- Development of business idea: Value Proposition Canvas, Porter's 5 Forces, SWAT Analysis, Business Model Canvas.

Awards

JUN 2023 — **GOLD LEAF AWARD AT 2023 PRIME CONFERENCE**

- For ranking among the top 10% of the best papers with my work entitled "Design-Space Exploration of Mixed-precision DNN Accelerators based on Sum-Together Multipliers". Certificate.

JUL 2020 — **YOUNG FELLOWS POSTER PRESENTATION AWARD AT 2020 DESIGN AUTOMATION CONFERENCE (DAC).**

- For one of the best students' poster presentations as a 2-minutes elevator pitch. I was presenting my Master's Thesis work entitled: "Detection of food contaminants with Microwave Sensing and Machine Learning". Certificate.

Main University Projects

DEC 2019 — **TRAINING OF MACHINE-LEARNING MODELS AND HARDWARE IMPLEMENTATION ON FPGA (MASTER'S THESIS)**

- Detection of food contaminants in hazelnut-cocoa spread jars using Microwave Sensing and Machine Learning: training Support Vector Machine (SVM) and Multilayer Perceptron (MLP) binary classifiers, generate artificial datasets, hyper-parameter search with grid-search and Bayesian Optimization, hardware accelerator of the best MLP model on FPGA.

Skills:Python, Scikit-Learn, Keras, Jupyter Notebook, conda, Matlab, hls4ml, Vivado HLS).

GEN 2019 - OCT 2017 — **DIGITAL HARDWARE DESIGN (TEAMWORKS)**

- Finite Impulse Response (FIR) filter with unfolding and pipelining
- Modified Booth Encoded Multiplier with compressor.
- MIPS-lite processor with data hazard bypasses (VHDL, QuestaSim).
- Logic circuit based on memristor sensing for fault-tolerant photovoltaic arrays: optimize solar cell connections to boost output power and prevent hot spots (paper).
- Fault Tolerant Photovoltaic Array
- Logic Analyzer with 8 channels, programmable sampling frequency, trigger condition, glitch detector, RS232 interface, tested on Altera DE2.
- Radix-2 "Butterfly" Fast Fourier Transform (FFT) processing element.
- CMOS AND4 X1 standard cell: transistor sizing, schematic, simulation, layout, characterization with parasitics extraction.

Skills: VHDL, QuestaSim, Quartus, Cadence Virtuoso, Teamworking.

OCT 2017 — **PRINTED CIRCUIT BOARD (PCB) DESIGN WITH DISCRETE COMPONENTS (BACHELOR'S THESIS)**

- Interface circuit based on Near-Field Communication (NFC) for low-power sensor nodes: circuit design, research of components on the market, datasheet, breadboard prototyping, PCB design, microcontroller programming.

Skills: LTSpice, KiCad, C language.

JUN 2017 — **FRONT-END DEVELOPMENT**

- Smartphone App called "Rimini Audioguida": play Italian/English audioguides in proximity of the main monuments of Rimini's city center.

Skills: HTML, JavaScript, CSS, Apache Cordova.