



# LUCA URBINATI

## CURRICULUM VITAE



Born / 13/02/1995 Age / 27  
Place of birth / RIMINI (RN)  
Nationality / citizenship / Italy  
Via Lombardia, 39, 47923 RIMINI (RN)  
Driving licence / B  
ID / 4563162 updated on 24/06/22

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### SOFT SKILL

Autonomy 9/10  
Self confidence 8/10  
Flexibility/Adaptability 8/10  
Resistance to stress 7/10  
Ability to plan and organize 8/10  
Managing information 9/10  
Precision/Attention to details 9/10  
Learn continuously 9/10  
Achievement of objectives 9/10  
Entrepreneurial spirit and initiative 8/10  
Communication 9/10  
Problem Solving 9/10  
Team work 8/10  
Leadership 8/10

### FOREIGN LANGUAGE SKILLS

MOTHER TONGUE(S): Italian



ENGLISH  
GOOD B2 B2 B2 B2 B2

### DIGITAL COMPETENCES

**Self-assessment grid**   
Information processing **Proficient user**  
Communication **Proficient user**  
Content creation **Independent user**  
Safety **Basic user**  
Problem solving **Proficient user**

### EXPECTATIONS AND FEATURES OF THE DESIRED JOB

ECONOMIC SECTOR: 1. education, training, research and development / 2. computer science, data processing and acquisition / 3. food

CAREER FIELD: 1. R&D and patents / 2. Engineering and design / 3. Quality and security

DESIRED JOB: **Digital Hardware Designer**

PREFERRED DISTRICT TO WORK IN: 1. RIMINI / 2. FORLI'-CESENA

### Career Goal

*I would like in research and development to work artificial intelligence algorithms in embedded devices and solve industrial problems such as predictive maintenance, quality control and defect detection.*

*I like traveling to seaside places, cycling and sailing, eating good food, watching science fiction films, playing with cats and at Risk.*



### WORK EXPERIENCES

#### Dottorando

#### POLITECNICO DI TORINO

Computer science, data processing and acquisition  
TORINO (TO)  
11/2020 - TODAY

**Main activities and responsibilities:** Embedded Machine Learning

**Acquired skills and achieved objectives:** Since October 2020 I started studying convolution, in its 2D and Separable variants (Depth-wise + Point-wise). I approached the world of High Level Synthesis (HLS) using Mentor Catapult HLS to create these two algorithms in order to exploit a type of precision reconfigurable multiplier that features the Sum Together (ST) mode [1]. It is capable of low-precision dot products directly in it, reducing the number of multiply-and-accumulate (MAC) operations and compute latency when working with 8- and 4-bit operands. The sector of application is: mixed-precision quantized networks for edge devices.

Between January and March 2021 I collaborated in the improvement of the real-time system for the recognition of contaminants in chocolate jars along an industrial production line using Machine Learning and FPGA (MIT-Food project [2]), publishing this article [3].

I studied Neural Architecture Search (NAS) algorithms to build a new convolutional network to participate in the Design Automation Conference (DAC) Contest 2021 [4] with my 'HLS' team.

In March 2022 I was the laboratory assistant of Prof. Mario Casu for the Digital Microelectronics course at the Polytechnic of Turin.

In May 2022 I presented this article [5] at the ISCAS 2022 conference, Austin, Texas (USA) [6].

Now I'm working on the publication of the work on the reconfigurable accelerator for 2D-Convolution, again based on the ST multiplier.

[1] L. Mei et al., "Sub-Word Parallel Precision-Scalable MAC Engines for Efficient Embedded DNN Inference," doi: 10.1109 / AICAS.2019.8771481

[2] <https://bit.ly/MIT-Food-Project>

[3] M. Ricci et al., 'Machine-Learning-Based Microwave Sensing: A Case Study for the Food Industry,' doi: 10.1109 / JETCAS.2021.3097699

[4] <https://bit.ly/DAC-Contest-2021>

[5] L. Urbinati and M. R. Casu, 'A Reconfigurable Depth-Wise Convolution Module for Heterogeneously Quantized DNNs,'

[6] <https://www.iscas2022.org>

Employed as: other - fixed-length contract | Company sector: Engineering and design

AVAILABILITY FOR BUSINESS TRAVELS:

**Yes, even frequently**

AVAILABILITY TO RELOCATE ABROAD:

**Yes, even in non-European countries**

## Predoctoral Fellow

**POLITECNICO DI TORINO**

*Computer science, data processing and acquisition*  
TORINO (TO)

05/2020 - 10/2020

**Main activities and responsibilities:** Embedded Machine Learning

**Acquired skills and achieved objectives:** In these six months I started my PhD research on 'Embedded Machine Learning' which consists in implementing Artificial Intelligence (AI) algorithms in edge devices through a HW-SW co-design approach. This activity is particularly complex because it is necessary to take into account the limited computational and energy resources, together with the constraints of low computing latency of the embedded devices, which are opposed to the expensive requirements of accurate AI algorithms.

Between May and June 2020 I participated in the DAC Contest 2020 [1] with my research group. The competition consisted in implementing a Deep Neural Network (DNN) on FPGA for the recognition and classification of objects in video frames taken from a drone, paying attention to the use of hardware resources, energy, frames per second and accuracy (Intersection over Union). My task involved training the neural network called SkyNet [2] in PyTorch.

In July 2020 I participated in the Design Automation Conference (DAC) 2020 [3] and in the DAC2020 Young Fellow Program, in which I won the award for best poster presentation, presenting the summary of my master's thesis in 2 minutes [4].

In October 2020 I virtually participated in the ISCAS2020 conference and presented the paper I wrote as the conclusion of my Master's thesis [5].

For more details, check the Publications and Awards section of my profile.

[1] <https://bit.ly/DAC-Contest-2020>

[2] X. Zhang et al., 'SkyNet: A Champion Model for DAC-SDC on Low Power Object Detection,' 2019, arXiv: 1906.10327

[3] <https://www.dac.com>

[4] <https://bit.ly/DAC2020-Poster-Presentation>

[5] L. Urbinati et al. 'A Machine-Learning Based Microwave Sensing Approach to Food Contaminant Detection,' doi: 10.1109 / ISCAS45731.2020.9181293

Employed as: other - fixed-length contract | Company sector: Engineering and design

## Technical Assistant

**FABLAB ROMAGNA APS**

*Entertainment services and cultural activities*

RIMINI (RN)

05/2014 - 10/2017

**Main activities and responsibilities:** I helped FabLab Romagna to organize events such as MakerFaire Rome 2014, Rimini Beach Mini Maker Faire 2015 and internal workshops of the association. I also attended the fablab as a maker creating small projects with Arduino and ESP8266-based boards, dedicating myself to program them in C.

**Acquired skills and achieved objectives:** Maker's philosophy, human relationship, cooperation, sharing of ideas between members, C programming, 3D printing.

Volunteer activities

## other information

Currently employed: Yes



**PH.D.**

2020 - 2023

**ONGOING STUDIES**



**MASTER'S DEGREE**

## ACADEMIC STUDIES

**Politecnico di TORINO**

**Faculty: Dipartimento Elettronica e Telecomunicazioni**

**Embedded machine learning**

Expected graduation date: 2023

**Politecnico di TORINO**

2017 - 2019  
CERTIFIED TITLE



**Dipartimento di Elettronica e Telecomunicazioni**  
**Ingegneria elettronica (electronic engineering)**  
LM-29 - 2nd level degree in Electronic engineering  
Dissertation/thesis title: Detection of food contaminants with Microwave Sensing and Machine Learning | Thesis supervisor: CASU, MARIO ROBERTO  
Age at graduation: 24 | Official duration: 2 years  
Final degree mark: **110/110**  
Graduation date: 18/12/2019

**BACHELOR'S DEGREE**  
2014 - 2017  
CERTIFIED TITLE



**Alma Mater Studiorum - Università di Bologna**  
**Scuola di Ingegneria e Architettura**  
**Ingegneria elettronica per l'energia e l'informazione**  
L-8 - 1st level degree in Information technology  
Dissertation/thesis title: Interface Circuit Design based on NFC for Low Power Sensor Nodes | Dissertation/thesis subject: Elettronica dei Sistemi Digitali | Thesis supervisor: ROMANI ALDO  
Age at graduation: 22 | Official duration: 3 years  
Final degree mark: **109/110**  
Graduation date: 05/10/2017



## FOREIGN LANGUAGE SKILLS

### DIPLOMAS AND CERTIFICATES

English IELTS, IDP IELTS Australia, 30 Sep 2017 , **Europass level B2**



## INFORMATION TECHNOLOGY SKILLS

### OFFICE AUTOMATION

**Presentation Software:** Google Slides (Advanced) , Keynote (Foundation) , Microsoft PowerPoint (Advanced) , Prezi (Foundation) | **Spreadsheets:** Apple Numbers (Foundation) , Google Sheets (Advanced) , Microsoft Excel (Advanced) | **Word Processors:** Google Docs (Advanced) , LaTeX (Intermediate) , Microsoft Word (Highly Specialised)

### APPLICATION SOFTWARE

**CAD - Assisted Design:** Cadence Innovus (Foundation) , Cadence Virtuoso (Foundation) , KiCad (Foundation) , Mentor Catapult HLS (Intermediate) , Synopsys Design Compiler (Foundation)

### COMPUTER PROGRAMMING

Scikit-Learn (Intermediate) , TensorFlow/Keras (Intermediate) | **Development Models:** ModelSim (Advanced) , SPICE (Foundation) | **Integrated development environments (IDE):** Arduino IDE (Advanced) , Jupyter Notebook (Advanced) , Mentor Catapult HLS (Intermediate) , Quartus II (Intermediate) | **Markup languages:** CSS (Foundation) | **Programming languages:** C (Advanced) , HTML (Foundation) , JavaScript (Foundation) , MATLAB (Advanced) , Python (Advanced) , VHDL (Advanced)

### SYSTEMS AND NETWORKS MANAGEMENT

**Operating systems:** Linux (Intermediate) , MacOS (Advanced) , Microsoft Windows (Intermediate)

### DATA MANAGEMENT

**Big Data:** PySpark (Foundation)

### GRAPHICS AND MULTIMEDIA

**3D graphics:** SketchUp (Intermediate) | **Raster graphic editor:** Draw.io (Advanced) | **Video Editing and Processing:** iMovie (Advanced)

### ICT CERTIFICATES

**General Safety and Health Training** Alma Mater Studiorum - Università di Bologna, 26/02/2017  
**Structuring Machine Learning Projects** Coursera, 2021



## STUDIES AND EXPERIENCES ABROAD

### SWEDEN

European Union program (ERASMUS+)

2016

Place: **Linköping (Sweden)** | Language: English | Duration: 5 (months)  
First semester of the third year of Bachelor Degree at Linköping University, from August 2016 to January 2017.



## PROFESSIONAL ACCOLADES AND AWARDS

**PRIZE**  
01/07/2020

**DAC2020 Young Fellows Poster Presentation Award**  
**Grading in list:** Primi 20  
[bit.ly/DAC2020-Poster-Presentation](https://bit.ly/DAC2020-Poster-Presentation)



## EVENTS / EXHIBITIONS

**PROJECT**  
2021

### **MicroFoodDetector**

Creation of a business model to commercialize the 'Microwave Imaging for Food' research of the Politecnico di Torino (contact person F. Vipiana): <https://bit.ly/MIT-Food-Project>

Authors: D. Balice, E. Ezemobi, D. Giordino, M. Mahdavishtarif, L. Urbinati, A. Valerio

'Our product helps food manufacturers improve their quality control systems by identifying foreign objects in packaged foods on the conveyor belt using microwave detection and machine learning.'

Politecnico di Torino

Character: Project Manager

[bit.ly/MicroFoodDetector](https://bit.ly/MicroFoodDetector)

**PROJECT**  
2019

### **Integrated System Architecture**

Design and implementation of:

- an 8th-order digital FIR filter with unfolding degree 3 and pipelining;
- digital arithmetic circuits such as a MBE (Modified Booth Encoding) multiplier based on Roorda's approach and approximate multipliers;
- a MIPS-lite processor with a reduced ISA and with data hazard bypasses.

Software used: ModelSim, Synopsys Design Compiler, Cadence Innovus.

For more details, see the documentation.

[bit.ly/lucaurbinati-project-7](https://bit.ly/lucaurbinati-project-7)

**PROJECT**  
2019

### **Detection of food contaminants with Microwave Sensing and Machine Learning**

The goal of this thesis is to apply Machine Learning algorithms to a Microwave Sensing system to identify foreign objects in hazelnut-cocoa spread jars on the conveyor belt.

The results are: 10-folds CV accuracy of 95.052% for a SVM and 5-folds CV accuracy of 95.833% for a MLP, with 6.04% of error over a test set of 480 samples, for both.

The MLP is implemented in hardware with Vivado. The architecture with the lowest latency has 3 ms.

Editor: Mario Roberto Casu

Torino

Production: Tesi Magistrale

[webthesis.biblio.polito.it/13241/1/tesi.pdf](https://webthesis.biblio.polito.it/13241/1/tesi.pdf)

**PROJECT**  
2018

### **FFT Butterfly Processing Element**

The goal of this work was to design a Processing Element or Application Specific Processor capable of performing a BUTTERFLY, which is the basic unit of the Fast Fourier Transform

## PROJECT 2018

(FFT) calculation according to the Cooley-Tukey algorithm in Radix 2. The purpose was to derive a possible optimal architecture that would allow it to be executed in hardware, also satisfying the given specifications.

For more details, see the project documentation at the link below.  
[bit.ly/lucaurbinati-project-6](https://bit.ly/lucaurbinati-project-6)

### Logic Analyzer

The system was designed, implemented in VHDL with Quartus II, simulated with Modelsim and finally tested on the Altera DE2 board.

Main features:

- 8 channels
- sampling frequency per channel chosen by the user among: 5 MHz, 1 MHz, 200 KHz, 50 KHz, 10 KHz
- glitch detector on each channel
- trigger condition set by the user
- user interface via RS232 protocol, with 115.2 kbps transmission speed and 8n1 packet format, to show the acquisition results.

For more details, see the documentation.  
[bit.ly/lucaurbinati-project-5](https://bit.ly/lucaurbinati-project-5)

## PROJECT 2017

### Rimini Audioguida App

Description of the App.

Forget the stress of searching for information on the Internet! This App will allow you to listen to the description of the main monuments of the beautiful city of Rimini.

How does it work:

1. Walk around the city freely.
2. Nearby of a monument the smartphone will vibrate.
3. Listen to the audio guide!

The software used was Apache Cordova. The programming languages were: HTML, JavaScript, CSS.

For more details, see the activity report at the link below.  
[bit.ly/lucaurbinati-project-2](https://bit.ly/lucaurbinati-project-2)

## PROJECT 2017

### Interface Circuit Design based on NFC for Low Power Sensor Nodes

The purpose of the thesis work was to integrate the design of a nanocurrent sensor node, adding a communication interface with the outside world for the recovery of the acquired data that does not impact on the battery life time. In the project the Near Field Communication (NFC) technology was exploited.

Editor: Aldo Romani

Cesena

Production: Tesi Triennale

[amslaurea.unibo.it/14242/1/urbinati\\_luca\\_tesi.pdf](https://amslaurea.unibo.it/14242/1/urbinati_luca_tesi.pdf)

## PROJECT 2016

### Synthesizer with Echo

The system developed in this project is capable of generating an echo effect of its inputs, which can come from an external MP3 player or from the internally generated sound of a Piano note.

The system was built on the Cyclone II FPGA of the Altera DE2 board. The peripherals used are: keyboard, VGA screen, audio in and out.

For more details, see the activity report at the link below.  
[bit.ly/lucaurbinati-project-1](https://bit.ly/lucaurbinati-project-1)



## CONFERENCES 30/05/2022

## CONFERENCES AND SEMINARS

ISCAS 2022 , IEEE , Austin, Texas, USA  
Character: Presentatore

## CONVENTIONS

07/07/2021

[www.iscas2022.org](http://www.iscas2022.org)

**SIE 2021** , Società Italiana di Elettronica , Università di Trieste  
Presentation of the work entitled 'Microwave Sensing and Machine Learning for Food Safety'  
Character: Presentatore  
[sie-2021.units.it](http://sie-2021.units.it)

## CONFERENCES

01/10/2020

**ISCAS 2020** , IEEE , Virtuale (Siviglia, Spagna)  
Character: Presentatore  
[www.iscas2020.org](http://www.iscas2020.org)



## PUBLICATIONS

### CONFERENCE PROCEEDINGS

2022

**L. Urbinati and M. R. Casu**, A Reconfigurable Depth-Wise Convolution Module for Heterogeneously Quantized DNNs  
Organization: IEEE  
2022 IEEE International Symposium on Circuits and Systems (ISCAS)

### JOURNAL ARTICLES

2021

**M. Ricci, B. Štitić, L. Urbinati, G. Di Guglielmo, J. A. Tobon, L. P. Carloni, F. Vipiana, M. R. Casu**, Machine-Learning Based Microwave Sensing: A Case Study for the Food Industry  
Review: IEEE Journal on Emerging and Selected Topics in Circuits and Systems 2021  
Publisher: IEEE  
Special issue that improves the food contaminant detection system presented in the previous publication.  
DOI: 10.1109/JETCAS.2021.3097699  
[ieeexplore.ieee.org/document/9489295](https://ieeexplore.ieee.org/document/9489295)

### CONFERENCE PROCEEDINGS

2020

**L. Urbinati, M. Ricci, G. Turvani, J. A. Tobon, F. Vipiana, M. R. Casu, A** Machine-Learning Based Microwave Sensing Approach to Food Contaminant Detection  
Organization: IEEE  
IEEE 2020 International Symposium on Circuits and Systems (ISCAS)  
Scientific article written in conclusion of the master's thesis to participate in the FoodCAS 2020 conference in Seville.  
DOI: 10.1109 / ISCAS45731.2020.9181293  
[ieeexplore.ieee.org/abstract/document/9181293](https://ieeexplore.ieee.org/abstract/document/9181293)

### CONFERENCE PROCEEDINGS

2019

**L. Gnoli; G. Carnicelli; A. Parisi; L. Urbinati; B. Kabashi; F. Michieletti; S. I. Peredotto; M. Vacca; M. Graziano; J. Mathew; M. Ottavi**, Fault Tolerant Photovoltaic Array: A Repair Circuit Based on Memristor Sensing  
Organization: IEEE  
2019 IEEE International Symposium on DFT in VLSI and Nanotechnology Systems.  
Hardware implementation of an algorithm for the fault-recovery of a solar panel. The system detects cells with degraded performance using a memristor as a sensor. With the aim of improving the efficiency of energy production, the connections between the solar cells are reconfigured according to the state of the solar array cells.  
DOI: 10.1109 / DFT.2019.8875467  
[ieeexplore.ieee.org/abstract/document/8875467](https://ieeexplore.ieee.org/abstract/document/8875467)



## TEACHING ACTIVITIES

### LESSONS/LECTURES

2022

**Politecnico di Torino** , Torino  
Assistente del corso Microelettronica Digitale  
Teaching assistant to Prof. Mario Casu for the Digital Microelectronics course at the Politecnico di Torino for the academic year 2021/2022.  
Main Professor: Mario Casu  
Character: Assistente didattico

