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Lorenzo Lamberti

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WORK EXPERIENCE

01/01/2023 – CURRENT Zürich, Switzerland

VISITING PHD STUDENT ROBOTICS AND PERCEPTION GROUP - UNIVERSITY OF ZÜRICH

Supervisor: Prof. Dr. Davide Scaramuzza.
Topics: nano-drone racing with neuromorphic vision sensor (event-based cameras) and Deep Reinforcement Learning techniques.

08/2020 – CURRENT Bologna, Italy

PH.D. STUDENT UNIVERSITY OF BOLOGNA

Ph.D. student at the PULP-Lab.
Supervisors: Prof. Dr. Luca Benini, Dr. Daniele Palossi, Dr. Francesco Conti.
Research topics:

1. Neuromorphic vision applications for nano-drone racing;
2. Artificial intelligence for aerial nano-robotics: visual-based autonomous navigation algorithms for nano-drones. *[Open-source: www.github.com/pulp-platform/pulp-dronet];*
3. Neural Architecture Search (NAS) techniques for automated CNN design on constrained MCUs.

Tutor at Unibo, 3 courses: "Architectures for Artificial Intelligence M" (2021) and "Hardware/Software Design Methodologies M" (2021), "Architectures for Artificial Intelligence M" (2022).
Student thesis supervision: 12 in UniBo, 4 in ETH Zürich.
Academic Publications: 8
Secondary reviewer at: DATE2021 (Design, Automation and Test in Europe Conference), DATE2022, DATE2023, Computing Frontiers 2022.
Extra: examining board member for the Italian's engineering state exams (Jul 2021, Nov 2021).

Department Electrical, Electronic, and Information Engineering "Guglielmo Marconi" - DEI |

Address Viale del Risorgimento, 2, 40136, Bologna, Italy | **Website** www.pulp-platform.org

01/2020 – 08/2020 Bologna, Italy

AI EMBEDDED APPLICATION ENGINEER GREENWAVES TECHNOLOGIES

Development of deep learning algorithms for Optical Character Recognition (OCR). The outcome was a 2-step deep learning model for visual-only license plate detection (SSD) and text recognition (LPRNet), deployed on GreenWave's ultra-low-power MCU, GAP8, and running at 1FPS.
Open-sourced at: www.github.com/LorenzoLamberti94/license-plates-ocr

Address Viale Carlo Pepoli 3, 40123 , Bologna, Italy | **Website** www.greenwaves-technologies.com

01/2019 – 08/2019 Pasadena, California, United States

INTERNSHIP - AI RESEARCH INTERN AT DATALOGIC DATALOGIC USA

Master's Degree thesis (6 months).
Development of a deep learning system for industrial optical character recognition (OCR) applications, exploiting the state-of-the-art YOLO CNN. The network was specialized for the specific task of reading

character strings. The final model reached accuracy levels over 99.75% on 4 internal datasets, while running in real time (60-120 FPS on a Nvidia GTX1080).

Address 55W Del Mar blvd, 91105, Pasadena, CA, United States | **Website** www.datalogic.com/

06/2018 – 09/2018 Batavia (Chicago), Illinois, United States

INTERNSHIP - SCIENTIFIC COMPUTING DIVISION AT FERMILAB FERMI NATIONAL ACCELERATOR LABORATORY

Development of machine learning algorithms to analyze monitoring data streams from Fermilab's global computing grid, in order to rapidly detect and identify aberrant conditions such as: faulty grid nodes, network bottlenecks, system faults.

Department Scientific Computing Division |

Address Pine Street and Kirk Rd, 60510, Batavia (Chicago), Illinois, United States | **Website** https://www.fnal.gov

09/2017 – 03/2019 Bologna, Italy

DEGREE PROGRAMME TUTOR UNIVERSITY OF BOLOGNA

Degree Programme Tutor for the Chemichal Engineering Bachelor's Degree at University of Bologna.

Business or Sector Administrative and support service activities |

Address Viale del Risorgimento 2, 40136 , Bologna, Italy | **Website** www.unibo.it

EDUCATION AND TRAINING

11/2016 – 12/2019

MASTER'S DEGREE IN ELECTRONIC ENGINEERING Alma Mater Studiorum - University of Bologna

Field of study Electronic Engineering | **Final grade** 110 / 110 cum laude | **Level in EQF** EQF level 7 |

Type of credits ECTS | **Number of credits** 120 |

Thesis Deployment of a deep learning solution for industrial OCR applications

08/2013 – 12/2019

BACHELOR'S DEGREE IN ELECTRONIC AND TELECOMMUNICATIONS ENGINEERING Alma Mater Studiorum - University of Bologna

Field of study Electronic and Telecommunications Engineering | **Final grade** 110 / 110 cum laude |

Level in EQF EQF level 6 | **Type of credits** ECTS | **Number of credits** 180 |

Thesis Analysis of the use of wearable inertial sensors for the recognition of daily activities

DIGITAL SKILLS

Deep Learning Tools

PyTorch | TensorFlow | Keras | OpenCV

Programming

Python | C | Git | Linux | LaTeX | VHDL | Verilog | Pascal

ADDITIONAL INFORMATION

HONOURS AND AWARDS

16/09/2022

Nano-copeter AI Challenge: 1st placed – IMAV2022, TU Delft The "Nanocopter AI challenge" was the first international nano-drone racing competition, held at the International Micro Air Vehicles (IMAV) conference 2022.
My role: technical leader of the PULP-team.

Result: 1st placed (leaderboard).
Video: youtu.be/GLReJhf3GpY

Full team: *Lorenzo Lamberti*, Lorenzo Bellone[+], Elia Cereda[§], Gabriele Abbate[§], Victor Javier Kartsch Morinigo*, Michał Barciś[+], Agata Barciś[+], Alessandro Giusti[§], Francesco Conti*, Daniele Palossi[§].*
**University of Bologna, [+]Technology Innovation Institute, [§]USI-SUPSI IDSIA*

PUBLICATIONS

References

L. Lamberti, M. Rusci, M. Fariselli, F. Paci and L. Benini, "Low-Power License Plate Detection and Recognition on a RISC-V Multi-Core MCU-Based Vision System," 2021 IEEE International Symposium on Circuits and Systems (ISCAS), 2021, pp. 1-5, doi: 10.1109/ISCAS51556.2021.9401730.

V. Niculescu, **L. Lamberti**, D. Palossi and L. Benini, "Automated Tuning of End-to-end Neural Flight Controllers for Autonomous Nano-drones," 2021 IEEE 3rd International Conference on Artificial Intelligence Circuits and Systems (AICAS), 2021, pp. 1-4, doi: 10.1109/AICAS51828.2021.9458550.

V. Niculescu, **L. Lamberti,** F. Conti, L. Benini and D. Palossi, "Improving Autonomous Nano-Drones Performance via Automated End-to-End Optimization and Deployment of DNNs," in IEEE Journal on Emerging and Selected Topics in Circuits and Systems, vol. 11, no. 4, pp. 548-562, Dec. 2021, doi: 10.1109/JETCAS.2021.3126259.

L. Lamberti, V. Niculescu, M. Barciś, L. Bellone, E. Natalizio, L. Benini, D. Palossi, "Tiny-PULP-Dronets: Squeezing Neural Networks for Faster and Lighter Inference on Multi-Tasking Autonomous Nano-Drones," 2022 IEEE 4th International Conference on Artificial Intelligence Circuits and Systems (AICAS), 2022, pp. 287-290, doi: 10.1109/AICAS54282.2022.9869931.

M. Risso, A.Burrello, D.Jahier Pagliari, F. Conti, **L. Lamberti**, E. Macii, L. Benini, M. Poncino, "Pruning In Time (PIT): A Lightweight Network Architecture Optimizer for Temporal Convolutional Networks," 2021 58th ACM/IEEE Design Automation Conference (DAC), 2021, pp. 1015-1020, doi: 10.1109/DAC18074.2021.9586187.

M. Risso; A. Burrello; F. Conti; **L. Lamberti**; Y. Chen; L. Benini; E. Macii; M Poncino, D. Jahier Pagliari , "Lightweight Neural Architecture Search for Temporal Convolutional Networks at the Edge," in IEEE Transactions on Computers, doi: 10.1109/TC.2022.3177955.

T. Ingolfsson, M. Vero, X. Wang, **L. Lamberti**, L. Benini, and M. Spallanzani. 2022. "Reducing neural architecture search spaces with training-free statistics and computational graph clustering," In Proceedings of the 19th ACM International Conference on Computing Frontiers (CF '22). Association for Computing Machinery, New York, NY, USA, 213–214.

L. Lamberti, L. Bompani, V. J. Kartsch, M. Rusci, D. Palossi, L. Benini, "Bio-inspired Autonomous Exploration Policies with CNN-based Object Detection on Nano-drones," 2023 Design Automation and Test in Europe (DATE).

CONFERENCES AND SEMINARS

15/04/2021
Speaker at Bitcraze's AI-deck workshop Workshop on the AI-deck in collaboration with Bitcraze company to enable visual-based artificial intelligence algorithms aboard nano-drones.
Topics: Hardware explanation (GAP8 SoC and AI-deck specifics), software preliminaries, hands-on examples.
Slides/code: https://github.com/pulp-platform/AI-deck-workshop
Video: https://youtu.be/o9asYPHxEB4
Event: www.bitcraze.io/about/events/adws12021/

15/11/2022 – ETH Zurich.
Invited talk at ETH Zurich. Title: "AI-Driven Air Nano-Robotics" I gave a 1 hour talk presenting my research about autonomous navigation aboard nano-drones.
Course: "Projects & Seminars: Embedded Systems With Drones" link

STUDENT'S PROJECTS SUPERVISION

2020 – CURRENT
University of Bologna -- ETH Zürich

University of Bologna:

Bachelor's thesis:

1. Aurora Di Giampietro, Bachelor's Thesis. Title: "Study of Deep Learning Algorthms for Object Detection aboard Nano-Drones". (06/2021 - 10/2021)
2. Davide Graziani, Bachelor's Thesis. Title: "Development of Autonomous Exploration Algorithms for Nano-Drones using Time-of-Flight sensors". (11/2021 - 05/2022)
3. Lorenzo Squarzoni, Bachelor's Thesis. Title: "Shrinking Techniques for Deploying Object Detection Algorithms aboard Nano-Drones". (11/2021 - 10/2022)
4. Giulia Kodric', Bachelor's Thesis. Title: "Evaluation of SoA object detection algorithms for nano-drones". (04/2022 - 02/2023)
5. Iacopo Mandrelli, Bachelor's Thesis. Title: "Testing and In-field Evaluation of a vision-ranging fusion algorithm for autonomous nano-quadrotors". (08/2022 - 12/2022)
6. Diego Gorfini, Bachelor's Thesis. Title: "Implementation of a kalman filter for object detection traking on nano-drones". (04/2023 - ongoing)

Master's thesis:

1. Manuel Cintura, Master's Thesis. Title: "An Embedded Data Logger for In-Vehicle Testing". (03/2021 - 10/2021)
2. Luca Bompani, Master's Thesis. Title: "Robust Object Detection Methods for Nano-Drones". (03/2022 - 10/2022)
3. Samuele Bortolato, Master's Thesis. Title: "Deep Reinforcement learning for nano-drones". (03/2023 - ongoing).
4. Luca Angeli, Master's Thesis. Title: "Neuromorphic vision aboard nano-drones". (04/2023 - ongoing)

Semester thesis:

1. Luca Bompani. Semester Thesis. Title: "Deployment of an SSDLite Object Detector on a Nano-Drone using the GAPflow toolset". (12/2021 - 03/2022)
2. Afshin Khodaveisi, Semester Project. Title: "Object detection with iterative denoising algorithms". (04/2023 - ongoing)

ETH Zürich:

1. Daniel Ribien, Semester Thesis. Title: "Dataset building framework for PULP-based nano-drones". (02/2021 - 06/2021)
2. Mark Vero, Semester Thesis. Title: "Hardware Constrained Neural Architecture Search: An Analysis of the Training-Free Framework". (03/2021 - 07/2021)
3. Dimitrios Christodoulou, Semester Thesis. Title: "Deep Learning-based Global + Local Planner for Autonomous Nano-drones". (02/2022 - 07/2022)
4. Zichong Li, Semester Thesis. Title: "Sensor Fusion for Improved Collision Avoidance for Nano-drones". (05/2022 - 09/2022)

VOLUNTEERING

2017 – CURRENT Bologna, Italy
Blood donor -- AVIS: Associazione Volontari Italiani del Sangue www.avis.it/it

1 Giugno 2023,
Firma

Lorenzo Lamberti

Digita qui il testo