William Baisi

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Personal Presentation

I am an MSc student at Politecnico di Torino, driven by a curiosity to understand how things work. I'm passionate about electronics, computer architecture, and machine learning, and I'm excited by the impact these fields can have on improving people's lives. In my free time, I enjoy sports and playing chess.

Education

Politecnico di Torino, MS in Electronic Engineering, *Microelectronics*   Oct 2021 - Oct 2024
  Average exam marks: 29.3/30 – GPA: 3.92

Università di Modena and Reggio Emilia, BS in Electronic Engineering   Sept 2018 - Oct 2021
  Final mark 100/110

Experience

Visiting student, Columbia University, SLD group – New York, NY   Feb 2024 – Aug 2024

Worked on the MSc's thesis "A Machine Learning Approach to Optimizing CNN Deployment on Tile-Based Systems-on-Chip". Development of software application for efficient deployment of CNN on ESP. Extensive use of FPGA for testing. Leveraging ML techniques for CNN inference optimization.

Cell-based IC design training, Taiwan Semiconductor Research Institute, NARLabs   Dec 2023
– Hsinchu, Taiwan

Taiwan-Europe short term training program, offered by Taiwanese institutions to international students. Two weeks course on Cell-Based IC Design, Implementation and Verification.

Workshop "Innovative Systems", Politecnico di Torino – Torino, Italy   May 2022 - Apr 2023

Developed an ALU that leverages approximate arithmetic in the context of error tolerant applications with the goal of improving power efficiency and performance. Improvement of the design power performance using UPF directives during synthesis. Implementation of a standard cell library using CNTFET technology and characterization using Cadence Liberate. Synteshis of the ALU with CNTFET technology.

MoRe-Driverless Team, UNIMORE – Modena, Italy   Nov 2019 - Sept 2021

In the context of the Formula Student Championship, focusing on the development of automated controls for autonomous driving, specifically creating a C application to control the electric motors operating the vehicle.

Technical Strengths

Languages: - Proficient: C, Python, Bash - Familiar: C++, SystemC, TCL

EDA: VHDL, SystemVerilog

EDA Tools: Modelsim, Virtuoso, Design Compiler, Liberate, Innovus, LC shell, SPICE

Libraries: ScikitLearn, TensorFlow

OS: Linux, RTOS

Relevant Coursework

Computer Architecture: DSP, Arithmetic Circuits, RISC-V

Digital Design: VLSI design, Synthesis and Verification, Digital Microelectronics, Semiconductor physics, Optoelectronics

Machine Learning: Neural Networks, Convolutional Networks, Ensemble methods, Linear Regressions

Embedded Systems: Real-Time Operating Systems, Firmware developement

Languages

Italian: Native Language

English: DET – 130/160

French: DELF – B2

Projects

- Developed a mapping tool for CNNs optimal deployment on tile-based SoCs; Languages: Python, Libraries: ScikitLearn, XGBoost
- Developed a RISC-V General Purpose Processor, with Instruction Cache, Forwarding Unit and simple Branch Prediction; HDL: SystemVerilog

Statement of Purpose
Columbia University, PhD in Computer Science

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During my undergraduate studies, I pursued a degree in Electronics at the Enzo Ferrari Department of Engineering in Modena, a school primarily focused on automotive industry technologies with a strong emphasis on control theory and telecommunications. During this time, I participated in a project within the Formula Student competition, aiming to build an autonomous car to compete in the international championship. My role was to write low level applications for various microcontrollers distributed throughout the car, controlling the electrical actuators operating the vehicle. This experience allowed me to collaborate with mechanical engineers and computer scientists, acquiring interdisciplinary skills that enhanced my understanding of complex systems.

During the second year of my undergraduate studies, my introduction to computer architecture ignited a passion to which I realized I wanted to dedicate my career. Upon graduation, I enrolled at the Polytechnic of Turin to pursue a Master's degree in Microelectronics. Throughout this program, I expanded my knowledge across a wide range of subjects—from semiconductor physics and integrated circuit production processes, through IC design of digital and analog circuits, RF power amplifiers, optoelectronics fundamentals, and computer architecture, to system-level design using high-level synthesis. Although the master's program focused on hardware design within the VLSI paradigm, I enriched my curriculum with courses on embedded systems and machine learning, especially focusing on deployment on edge devices. Furthermore, I participated in a year-long multidisciplinary workshop where we designed a complete arithmetic logic unit leveraging approximate arithmetic. To optimize power consumption, we learned to exploit Unified Power Format during synthesis. Additionally, we developed and characterized a digital library of standard cells using CNTFET emerging technology and utilized the library in synthesis. This experience not only enhanced my ability to independently learn topics outside the scope of my existing knowledge but also introduced me to the world of research.

In November 2023, I was invited by Taiwanese authorities to participate in a short-term

program offered to several European universities. The course, titled "Cell-based IC Design and Verification," covered topics ranging from Verilog HDL, with which I was already familiar, to the place and route of integrated circuits, delving into the algorithms used in synthesis and place-and-route tools. During my stay in Hsinchu at TSRI-NARLabs, I had the privilege of interacting with numerous Master's and Ph.D. students from various countries and exploring diverse fields of study and research.

To acquire new skills, I joined the System Level Design (SLD) group at Columbia University for my Master's thesis project under the supervision of Professor Luca Carloni. The goal of the research project was to optimize CNN deployment on tile-based systems-on-chip architectures by leveraging machine learning techniques. To accomplish this task, I first contributed to the development of a flexible architecture that can accelerate intensive workloads in a highly configurable manner. Next, I created an extensive dataset of model performance on various SoC architectures through deploying the SoCs on FPGA and processing the results. Finally, I trained and tested machine learning models for predict the inference latency on diverse SoCs and leveraged this model in a mapper that can optimize neural network deployment. During this time, I had the chance to use ESP, a versatile SoC design platform, for the experiments and gained a deeper understanding of the organization of its complex hardware architecture and the software infrastructure. More importantly, I had the opportunity to interact with Professor Carloni and the students of his group, who consistently guided me in my research tasks and fostered the development of my skills, particularly in software and machine learning.

This experience led me to decide to apply for a Ph.D. in Computer Science in the SLD group, as it encompasses a wide range of research activities that excite me: hardware development at different levels of abstraction, the interaction between software and hardware, and continuing my research on the application of machine learning techniques in computer-aided design. I strongly believe that this long-term experience will help me grow both technically and in broader ways, such as complex problem-solving, efficiently explaining sophisticated concepts, working on multiple projects of different natures, and collaborating with diverse people. Although I have always considered pursuing a career in industry, I am deeply fascinated by academia. I see this experience as a way to better understand my future career, as every past

experience has influenced my subsequent choices.

The experience I gained within the System Level Design group and my interactions with Professor Carloni convinced me that I can contribute positively to the group by working on the development of ESP and using it as a vehicle for research projects in the fields of computer architectures and computer-aided design.

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