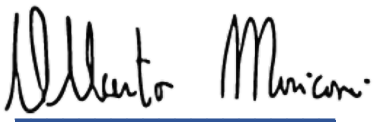
PhD in Information Technology and Electrical Engineering
Università degli Studi di Napoli Federico II

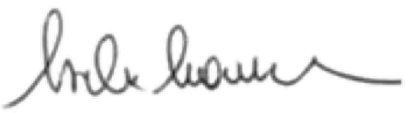
PhD Student: Alberto Moriconi

Cycle: XXXVII

Training and Research Activities Report

Year: First





Tutor: Prof. Nicola Mazzocca

Date: October 31, 2022

1. Information:

- **PhD student: Alberto Moriconi**
- **DR number: DR995869**
- **Date of birth: 29/05/1989**
- **Master Science degree: Computer Engineering University: Naples Federico II**
- **Doctoral Cycle: XXXVII**
- **Scholarship type: *no scolarship***
- **Tutor: Nicola Mazzocca**
- **Co-tutor:**

2. Study and training activities:

Activity	Type[1]	Hours	Credits	Dates	Organizer	Certificate[2]
Complexity and the City	**Seminar**	**1.5**	**0.3**	**23/11/2021**	**Futuro Remoto 2020**	**N**
Threat Hunting Use-Cases	**Seminar**	**2**	**0.4**	**13/12/2021**	**Prof. D. Cotroneo, Prof. S.P. Romano, Dr. R. Natella, DIETI – Unina**	**N**
Designing Quantum Algorithms	**Seminar**	**2**	**0.4**	**16/12/2021**	**Prof. A. S. Cacciapuoti, DIETI – Unina**	**N**
GDPR Basics for Computer Scientists	**Seminar**	**2**	**0.4**	**14/12/2021**	**Prof. Piero Bonatti, DIETI – Unina**	**N**
Intelligenza artificiale e sistemi d'arma autonomi	**Seminar**	**2**	**0.4**	**19/1/2022**	**Gruppo Interdisciplinare su Scienza, Tecnologia e Società (GI-STS) dell'Area della Ricerca di Pisa del CNR**	**N**
The learning	**Seminar**	**2**	**0.4**	**21/1/2022**	**CQB,**	**N**

landscape in deep neural networks and its exploitation by learning algorithms					**ITEE and ICTH PhD courses, DIETI**	
Virtualization technologies and their applications	**Courses**	**20**	**5**	**17/1 to 18/2 2022**	**Prof. Luigi De Simone, DIETI**	**Y**
Potential and challenges of next generation railway signaling systems: Moving Block and Virtual Coupling	**Seminar**	**1**	**0.2**	**6/4/2022**	**Prof. Valeria Vittorini (DIETI, UNINA)**	**N**
Piattaforma ACC di RFI	**Seminar**	**16**	**3.2**	**17-18/3/2022**	**Rete Ferroviaria Italiana S.p.A.**	**Y**
Introduction to MBSE & System Validation with SLRT	**Seminar**	**2**	**0.4**	**15/7/2022**	**The Mathworks srl, Rete Ferroviaria Italiana S.p.A.**	**Y**

1) Courses, Seminar, Doctoral School, Research, Tutorship
2) Choose: Y or N

2.1. Study and training activities - credits earned

	Courses	Seminars	Research	Tutorship	Total
Bimonth 1	-	**1.5**	**6.5**	-	**8**
Bimonth 2	-	**0.8**	**5.5**	-	**6.3**
Bimonth 3	**5**	**3.4**	**5**	-	**13.4**
Bimonth 4	-	-	**7**	-	**7**
Bimonth 5	-	**0.4**	**3.5**	-	**3.9**
Bimonth 6	-	-	**8.5**	-	**8.5**
Total	**5**	**6.1**	**36**	-	**47.1**
Expected	**30 - 70**	**10 - 30**	**80 - 140**	**0 – 4.8**	

3. Research activity:

The main topic of my first year of research has been the application of approximate computing techniques to automatic methodologies for the synthesis of approximate circuits.

The methodology, based on exact synthesis and multi-objective combinatorial optimization, has been implemented in an open-source logic synthesis framework and has been tested on extensive benchmarks, showing improvements when confronted with the state of the art.
While originally devised and tested for area and/or depth reduction on ASICs, the methodology showed promising results in power reduction on FPGAs; a power model has been devised in order to model the expected results and extensive test have been conducted to experimentally confirm the hypothesis.

Another part of my research activity pertains safety-critical railway systems; in this field, my main focuses have been memory protection for real-time operating systems for resource-constrained devices and proof-of-concept architectures for autonomous train operation.

4. Research products:

- *Barbareschi, M., Barone, S., Mazzocca, N., & Moriconi, A. (2022). A Catalog-based AIG-Rewriting Approach to the Design of Approximate Components. IEEE Transactions on Emerging Topics in Computing. (Journal paper, published, early access)*
- *Barbareschi, M., Barone, S., Mazzocca, N., & Moriconi, A. (2022). Design Space Exploration Tools. In Approximate Computing Techniques (pp. 215-259). Springer, Cham. (Book chapter, published)*
- *Barbareschi, M., Barone, S., Mazzocca, N., & Moriconi, A. Towards Catalog-based AIG-Rewriting Approximate Technique Based FPGA Synthesis.. (Journal paper, submitted)*
- *Barbareschi, M., Barone, S., Casola, V., Montone, P., & Moriconi, A. A Memory Protection Strategy for Resource Constrained Devices in Safety Critical Applications. The 6th International Conference on System Reliability and Safety. (Conference paper, accepted)*
- *PyAls (https://github.com/SalvatoreBarone/pyALS). Open source implementation of the methodology presented in the articles.*

5. Conferences and seminars attended

- AxC21: 6th Workshop on Approximate Computing (4/11/2021) – Presentation on Approximate Logic Circuits.
- 7th Italian Workshop on Embedded Systems (IWES 2022) (22-23/9/2022) – Presentation on the use of Approximate Logic Circuits for hardware accelerators in real-time systems.

6. Activity abroad:

None.

7. Tutorship

None.