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

PhD Student:

Cycle: XXXV

Training and Research Activities Report

Academic year: 2020-21 - PhD Year: Second


student signature

Tutor: prof. Nicola Mazzocca


tutor signature

Date: October 21, 2021

1. Information:

- **PhD student: Erasmo La Montagna** **PhD Cycle: XXXV**
- **DR number: DR993882**
- **Date of birth: 05/10/1992**
- **Master Science degree: Computer Engineering** **University: Università degli studi di Napoli Federico II**
- **Scholarship type: no scholarship**
- **Tutor: Nicola Mazzocca**
- **Co-tutor:**

2. Study and training activities:

Activity	Type[1]	Hours	Credits	Dates	Organizer	Certificate[2]
L'esperienza del progetto di teleriabilitazione NEUROREAB	Seminar	1.5	0.3	24/11/2020	Giovanni D'Addio	Y
Picariello Lecture IV, "#andràtuttobene: Images, Texts, Emojis & Geodata in a Sentiment Analisys Pipeline"	Seminar	1.5	0.3	25/11/2020	Giuseppe Luongo	Y
Scientific Colloquia at SSM, "The Ohta-Kawasaki model for diblock copolymers: stability and minimality of critical points"	Seminasr	1.5	0.3	26/11/2020	Marco Coraggio	Y
Telemedicina, e-health e «mobile health» si può davvero usare il digitale nel percorso assistenziale?"	Seminar	1.5	0.3	26/11/2020	Giovanni D'Addio	N

Picariello Lecture V, "At the Nexus of Big Data, Machine Intelligence, and Human Cognition" - Prof. George S. Djorgovski	**Seminar**	**1**	**0.2**	**02/12/2020**	**Giuseppe Luongo**	**Y**
Picariello Lecture VI, "Exploiting Deep Learning and Probabilistic Modeling for Behavior Analytics"	**Seminar**	**1**	**0.2**	**09/12/2020**	**Giuseppe Luongo**	**Y**
GDPR basics for computer scientists - Dr Rigo Wenning	**Seminar**	**1.5**	**0.3**	**10/12/2020**	**Prof. P. Bonatti**	**N**
Picariello Lecture VII, "Data Driven Transformation in WINDTRE through Managers voice"	**Seminar**	**2**	**0.4**	**16/12/2020**	**Giuseppe Luongo**	**Y**
Data Management	**Course**	**48**	**6**	**28/09/2020 22/12/2020**	**Prof. F. Amato**	**Y**
Picariello Lecture VIII, "From Photometric Redshifts to Improved Weather Forecasts: an interdisciplinary view on machine learning"	**Seminar**	**1**	**0.2**	**13/01/2021**	**Giuseppe Luongo**	**Y**
Scientific Colloquia at SSM, "Synchronization: a universal concept non-linear sciences"	**Seminar**	**1**	**0.2**	**14/01/2021**	**Marco Coraggio**	**Y**
Picariello Lecture IX, "Cybercrime and e-evidence: the criminal justice response"	**Seminar**	**2**	**0.4**	**20/01/2021**	**Giuseppe Luongo**	**Y**
Scientific Colloquia at SSM, "Probing Gravitational Field: a fundamental viewpoint"	**Seminar**	**1.5**	**0.3**	**21/01/2021**	**Marco Coraggio**	**Y**

Picariello Lecture X, "AI LEGAL: Artificial Intelligence for notary's sector - a case study"	**Seminar**	**1**	**0.2**	**27/01/2021**	**Giuseppe Luongo**	**Y**
Scientific Colloquia at SSM, "Quantum Simulators"	**Seminar**	**1.5**	**0.3**	**28/01/2021**	**Marco Coraggio**	**Y**
Picariello Lecture XI, "The era of Industry 4.0: new frontiers in business model innovation"	**Seminar**	**1**	**0.2**	**03/02/2021**	**Giuseppe Luongo**	**Y**
Picariello Lecture XII, Machine Learning: causality lost in translation"	**Seminar**	**1.5**	**0.3**	**10/02/2021**	**Giuseppe Luongo**	**Y**
Picariello Lecture XIII, "Approaches to Graph Machine Learning"	**Seminar**	**1.5**	**0.3**	**17/02/2021**	**Giuseppe Luongo**	**Y**
Picariello Lecture XIV, "Visual Interaction and Communication in Data Science"	**Seminar**	**2**	**0.4**	**03/03/2021**	**Giuseppe Luongo**	**Y**
Picariello Lecture XVI, "Sensoria Health"	**Seminar**	**1**	**0.2**	**17/03/2021**	**Giuseppe Luongo**	**Y**
Picariello Lecture XVIII, "Distributional Semantics Methods: How Linguistic features can improve the semantic representation"	**Seminar**	**1.5**	**0.3**	**28/04/2021**	**Giuseppe Luongo**	**Y**
Picariello Lecture XIX, "Ethics of Quantification"	**Seminar**	**2**	**0.4**	**26/05/2021**	**Giuseppe Luongo**	**Y**
Scientific Colloquium at SSM, "Synchronization in complex networks, hypergraphs and simplicial complexes"	**Seminar**	**1.5**	**0.3**	**27/05/2021**	**Marco Coraggio**	**Y**

Scientific Colloquium at SSM, "Dynamics of PDEs and recurrent motions",	**Seminar**	**1.5**	**0.3**	**03/06/2021**	**Marco Coraggio**	**Y**
Picariello Lecture XX, "Sadas Engine, an innovative DBMS for the DATA WAREHOUSE, great PERFORMANCE in the VLDB environment"	**Seminar**	**2**	**0.4**	**23/06/2021**	**Giuseppe Luongo**	**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	**0**	**2.3**	**7.7**	**0**	**10**
Bimonth 2	**6**	**2.5**	**1.5**	**0**	**10**
Bimonth 3	**0**	**0.9**	**9.1**	**0**	**10**
Bimonth 4	**0**	**1.4**	**8.6**	**0**	**10**
Bimonth 5	**0**	**0**	**10**	**0**	**10**
Bimonth 6	**0**	**0**	**10**	**0**	**10**
Total	**6**	**7.1**	**46.9**	**0**	
Expected	**30 - 70**	**10 - 30**	**80 - 140**	**0 – 4.8**	

3. Research activity:

In the first part of the year I finished my research work concerned upon obtaining a Strong PUF (expensive and difficult to obtain easily on commercial devices) starting from a weak PUF coupled with a symmetric cipher, the so called Pseudo PUF. Its efficiency has been analyzed in terms of metrics such as uniqueness, uniformity and bit-aliasing. The obtained results have been published on the journal "IEEE Transactions on Industrial Informatics" during this year.
Then I collaborated to the writing of a conference paper which analyzed the performance impact of the adoption of the PHEMAP protocol on a centralized Power Delivery Network compared to commonly adopted cryptography-based solutions. This work was the second attempt to put on evidence a real use case scenario for the adoption of PUFs to mutually authenticate devices. The paper has been successfully presented to the QUATIC 2021 conference on September 9, 2021.
To these days I am working on the realization of secure bootloader for Arduino Uno, one of the most popular microcontrollers in the world of Internet of Things, but also one of the most limited device on the market today. The aim of this work is to provide a highly reliable hardware-based root of trust based on an SRAM PUF coupled with the Fuzzy Extractor algorithm, in order to guarantee an equally reliable chain of trust for the applications hosted by the microcontroller and the collected data.

4. Research products:

Scientific Paper:

- Title: On the Adoption of Physically Unclonable Functions to Secure IIoT Devices
- Authors: M. Barbareschi, V. Casola, A. De Benedictis, E. La Montagna, N. Mazzocca
- Journal: IEEE Transactions on Industrial Informatics
- Current Status: Published
- Year of Publication: 2021
- Indexed in Scopus: Yes

Conference Paper:

- Title: Enforcing mutual authentication and confidentiality in Wireless Sensor Networks using Physically Unclonable Functions: a case study
- Authors: M. Barbareschi, E. La Montagna, S. Barone, A. Fezza
- Conference Name: 14th International Conference on the Quality of Information and Communications Technology – QUATIC 2021
- Current Status: Published
- Year of Publication: 2021
- Indexed in Scopus: Yes

5. Conferences and seminars attended

- Conference Name: 14th International Conference on the Quality of Information and Communications Technology
- Acronym: QUATIC 2021
- Place: University of Algarve, Faro, Portugal
- Dates: September 8-11, 2021
- Presented Paper: #75 Enforcing mutual authentication and confidentiality in Wireless Sensor Networks using Physically Unclonable Functions: a case study - Mario Barbareschi, Erasmo La Montagna, Salvatore Barone and Alfonso Fezza

6. Periods abroad and/or in international research institutions

7. Tutorship

8. Plan for year three

For the next year I am going to expand the field of application of the Physical Unclonable Functions to the world of hypervisors and vitualization. The aim of this idea is to provide several trusted services to

the virtual machines running on an embedded hypervisor. PUFs will be adopted as root of trust for all the services provided to the virtual machines.
For this activity I started a collaboration with another research team hosted by the University of Grenoble and guided by Giorgio Di Natale.
As the end of the PhD is approaching, I am quite convinced that the main topic of my thesis will be the adoption of Physical Unclonable Functions as root of trust for embedded devices, with more accurate analysis on how much the adoption of PUFs would impact on the security at a higher level of the platform (e.g. applications, communication, etc).