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

PhD Student: Giovanni Stanco

Cycle: XXXV

Training and Research Activities Report

Academic year: 2020-21 - PhD Year: Second

Giovanni Stanco

Tutor: Prof. Giorgio Ventre *tutor signature*

Co-Tutor: Prof. Alessio Botta, Ing. Flavio Frattini

Date: October 21, 2021

1. Information:

- **PhD student: Giovanni Stanco** **PhD Cycle: XXXV**
- **DR number: 993896**
- **Date of birth: 11/09/1992**
- **Master Science degree: Telecommunications Engineering**
- **University: University of Naples 'Federico II'**
- **Scholarship type: RisLab SRL (industry)**
- **Tutor: Prof. Giorgio Ventre**
- **Co-tutor: Prof. Alessio Botta, Ing. Flavio Frattini**

2. Study and training activities:

Activity	Type[1]	Hours	Credits	Dates	Organizer	Certificate[2]
AI4NETS – AI/ML for data communication Networks	Seminar	3	0.6	2/11/2020	Dr. Casas	Yes
GDPR basics for computer scientists	Seminar	1.5	0.3	10/12/2020	Prof. Bonatti	Yes
Digital project management	Seminar	1	0.2	18/11/2020	Prof. Carotenuto	Yes
Images, texts, emojis & geoidata in a sentiment analysis pipeline	Seminar	1.5	0.3	25/11/2020	Dr. Pelosi	Yes
At the Nexus of Big Data, Machine Intelligence, and Human Cognition	Seminar	1	0.2	2/12/20	Prof. Djorgovski	Yes
Exploiting Deep learning and probabilistic modeling for behavior analysis	Seminar	1	0.2	9/12/2020	Prof. Manco	Yes
Data driven transformation in Windtre through managers voice	Seminar	2	0.4	16/12/2020	Dr. Savarese, Bertone, Kudasheva	Yes
From Photometric Redshifts to Improved Weather Forecasts: an interdisciplinary view	Seminar	1	0.2	13/01/2021	Kai Polsterer	Yes

on machine learning						
Cybercrime and e-evidence: the criminal justice response	Seminar	1	0.2	20/01/2021	Matteo Lucchetti	Yes
AI LEGAL: Artificial Intelligence for notary's sector - a case study	Seminar	1	0.2	27/01/2021	Salvatore Palange	Yes
The era of Industry 4.0: new frontiers in business model innovation	Seminar	1	0.2	03/02/2021	Prof. Marco Balzano	Yes
Machine learning: Causality lost in translation	Seminar	1.5	0.3	10/02/2021	Prof. Edwin A. Valentijn	Yes
Statistical data analysis for science and engineering research	Ad hoc course		4		Prof. Roberto Pietrantuono	Yes
Dai mainframe all'IoT, una retrospettiva sull'evoluzione delle architetture di calcolo,	Seminar	2	0.4	08/03/2021	Prof. Mazzeo	Yes
Artificial Intelligence and 5G combined with holographic technology: a new perspective for remote health monitoring	Seminar	2	0.4	27/04/2021	Ferraro, Memmolo	No
Visual Interaction and communication in Data Science	Seminar	2	0.4	03/03/2021	Quartulli	Yes
Big data and computational linguistics	Seminar	2	0.4	10/03/2021	Cutugno	Yes
Sensoria Health	Seminar	1	0.2	17/03/2021	Rossetti	Yes
Distributional Semantics Methods: how linguistic features can improve the semantic representation	Seminar	1.5	0.3	28/04/2021	Maisto	Yes
Ethics of quantification	Seminar	2	0.4	26/5/2021	Prof. Saltelli	Yes
5G: l'architettura, le applicazioni e la rete di accesso radio	Seminar	2	0.4	08/06/2021	Ing. Mollica	Yes
Thriving as a doctoral	Seminar	1.5	0.3	08/10/2021	Prof. Dr.	No

student in informatics					**Fitzpatrick**	
Qiskit: state of the art and tools for Quantum Computers from IBM	**Seminar**	**1.5**	**0.3**	**15/10/2021**	**Dr. Accetta**	**Yes**

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**	**2,20**	**7,80**	**0**	**10**
Bimonth 2	**0**	**1,10**	**8,90**	**0**	**10**
Bimonth 3	**4**	**2,10**	**3,90**	**0**	**10**
Bimonth 4	**0**	**0,80**	**9,20**	**0**	**10**
Bimonth 5	**0**	**0**	**10**	**0**	**10**
Bimonth 6	**0**	**0,60**	**9,40**	**0**	**10**
Total	**4**	**6,80**	**49,20**	**0**	**10**
Expected	**30 - 70**	**10 - 30**	**80 - 140**	**0 – 4.8**	

3. Research activity:

One of the main research activities carried out in the second year was testing three LPWAN technologies using an IoT testbed. The testbed was made of programmable boards that communicate via different networks (Sigfox, LoRaWAN, NB-IoT). The goal of this activity was to evaluate performance parameters of the network technologies employed, in particular the evaluated metrics were the device clock accuracy, the energy efficiency, the message losses, and the latency of a message. The employed devices sent messages using the different networks and the messages were collected by a database server in order to perform the analysis. Obtained results show that LoRaWAN had the smallest average and maximum latency measured (2.4 and 6.8 seconds respectively) but a fraction of 2\% of the sent messages was typically lost. NB-IoT did not lose messages in multiple repetitions and had the minimum latency value measured (1.6 seconds). However the number of messages sent with a fully charged battery (200) was much smaller than the number of messages sent via LoRaWAN in the same condition (375). Sigfox was the best choice among the three technologies tested in terms of energy efficiency (395 sent messages) and message losses (always 0\%), but the latency reached peak values of 100 seconds that were not measured with the other technologies.

Another activity carried out was studying literature about security in IoT networks. The main focus was on the short range (BLE, Zigbee, etc.) and long range (LoRaWAN, Sigfox, NB-IoT, 5G) communication technologies and their possible attacks and countermeasures. This research in literature is aimed at realizing a survey on this topic.

I am currently preparing a conference paper on the practical research activity that will be soon submitted. I am also working on the survey on the security of IoT wireless networks and on a journal paper about DewROS , a project I previously worked on.

4. Research products:

Authors	Giovanni Stanco, Alessio Botta, Flavio Frattini, Ugo Giordano, Giorgio Ventre
Title	On the performance of LPWAN technologies for IoT: the case of Sigfox, LoRaWAN and NB-IoT
Conference	2022 ICC IEEE International Conference on Communications
Status	To be submitted soon

5. Conferences and seminars attended

Seminars are reported in the previous table. Some them are part of the "Picariello Lectures" series. Some are seminars organized by teachers during their MSc courses. The "AI4NETS – AI/ML for data communication Networks" was part of Performance 2020 - 38th International Symposium on Computer Performance, Modeling, Measurements and Evaluation 2020, organized by Politecnico di Milano.

6. Periods abroad and/or in international research institutions

7. Tutorship

8. Plan for year three

In my third year I will start and complete my visiting period abroad at University of Lancaster. I will work with Prof. Matthew Bradbury on how to perform task offloading in IoT using trust models that access to network attributes to take an informed decision for task offloading. This period will also include practical activity on IoT sensors attached on Raspberry Pis. We also plan to collaborate with other research groups from other British universities regarding task offloading in cellular networks. At the end of this visiting period we will hopefully submit a conference paper.

Another goal for next year is to finalize the preliminary results obtained so far during the practical activity research.

Research in year three will also focus on the security problems of IoT. IoT networks are subject to different attacks (jamming, replay, Man in the Middle…). These threats have already been reported in literature. Our goal will be to practically evaluate the impact of these threats and find the appropriate countermeasures in order to mitigate the setbacks caused by malicious attackers.