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

PhD Student: Patrizia Quaranta

Cycle: XXXVIII

Training and Research Activities Report

Year: First

student signature

Tutor: prof. Roberto Pietrantuono

Co-Tutor:

Date: October 16, 2023

Training and Research Activities Report

PhD in Information Technology and Electrical Engineering

Cycle: **Author:**

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1. Information:

- ➢ **PhD student: Patrizia Quaranta**
- ➢ **DR number: 996635**
- ➢ **Date of birth: 25/05/1992**
- ➢ **Master Science degree: Computer Engineering**
  University: Università degli Studi di Napoli "Federico II"
- ➢ **Doctoral Cycle: XXXVIII**
- ➢ **Scholarship type: PNRR DM. 352**
- ➢ **Tutor: Roberto Pietrantuono**
- ➢ **Co-tutor:**

2. Study and training activities:

Activity	Type[1]	Hours	Credits	Dates	Organizer	Certificate [2]
La nuova sfida delle Quantum Technologies per l'ecosistema dell'innovazione e della ricerca campano"	Seminar	3	0,6	07/11/22	The European House – Ambrosetti	N
Threat Hunting & Incident Response	Seminar	2	0,4	13/11/22	Prof. Simon Pietro Romano	N
Is Control a problem solved for Aerial Robotics Research?	Seminar	1	0,2	12/01/23	Prof. Fabio Ruggiero	Y
Embrancing Data Imperfections	Seminar	1	0,2	13/02/23	Prof. Antonio De Maio	Y
Algorithm Unrolling: Efficient, Interpretable Deep Learning for Signal and Image Processing	Seminar	1	0,2	14/02/23	Prof. Antonio De Maio	Y
Multi-robot Control of Heterogeneous Herds	Seminar	1	0,2	16/02/23	Dr Francesco Bajardi	Y
NTD in contesto aeronautico	Seminar	1	0,2	17/02/23	Prof. Carlo Forestiere	Y
Analysis and control of functional brain networks	Seminar	1	0,2	09/03/23	Dr Giacomo Ascione	Y
Artificial Intelligence for Defense Seabed-to Space Situational Awareness	Seminar	1	0,2	10/03/23	Prof. Antonio De Maio	Y

CARE-CRUI "open access with IEEE" webinar	Seminar	1,5	0,3	05/04/23	CARE-CRUI and IEEE	Y
Enhancing quit readout with Bayesian Learning	Seminar	1	0,2	05/04/23	Vincenzo D'Ambrosio	Y
Symbiotic Control of Wearable Soft Suits for human motion assistance and augmentation	Seminar	2	0,4	26/05/23	Prof. Fanny Ficuciello	Y
Open-source software e sicurezza della software supply chain	Seminar	2	0,4	08/06/23	Prof. Roberto Natella	Y
Traffic Engineering with Segment Routing: optimally dealing with most popular use-cases	Seminar	1	0,2	23/06/23	Prof. Valerio Persico	Y
2nd Generation of Mobile EEG Systems: Hands-on Experience	Seminar	1	0,2	29/06/23	Prof. Pasquale Arpaia	Y
Exploring Advanced Aerial Robotics: A Journey into Cutting-Edge Projects and Neural Control	Seminar	1	0,2	29/06/23	Julien Mellet	Y
Models of human motor coordination – a critical assessment and some open problems	Seminar	1	0,2	29/06/23	Scuola Superiore Meridionale	Y
BGP & Hot-Potato Routing: graceful and optimal convergence in case of IGP events	Seminar	1	0,2	30/06/23	Prof. Valerio Persico	Y
Ricerca e formazione nella società della transizione digitale	Seminar	5	1	22/09/23	Prof. Stefano Russo	N
A cosa servono le riviste?	Seminar	1,5	0,3	27/09/23	Springer Nature	N
Using Deep Learning Properly	Course	-	4	31/01/ 23	Prof. Andrea Apicella	Y
Scientific Programming And Visualization with Python	Course	-	2	23/02/23	Prof A. Botta	Y
How to Boost Your PhD	Course	-	4	19/04/23	Prof.ssa Antigone Marino	Y

Virtualization and their Technologies	Course	-	5	17/03/23	Prof. Luigi De Simone	Y
Statistical Data Analysis	Course	-	4	30/05/23	Prof. Roberto Pietrantuono	Y
Trasformazione Digitale	Course	-	3	16/06/23	Prof. Francesco Tortorelli	Y
Scienza Moderna e Disciplina Giuridica dell'Intelligenza Artificiale	Course	-	6	10/07/23	Prof Lucio Franzese	Y
Academic Entreprenuership	Course	-	4	17/07/23	Prof. Pierluigi Rippa	Y
SIESTA2023	Doctoral School	-	3	13/09/23	Michele Lanza	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	6	0	7
Bimonth 2	6	1	7	0	14
Bimonth 3	9	0,9	3	0	12,9
Bimonth 4	7	1,8	2	0	10,8
Bimonth 5	10		0	0	10
Bimonth 6	3	1,3	6	0	10,3
Total	35	6	24	0	65
Expected	30 - 70	10 - 30	80 - 140	0 – 4.8	

3. Research activity:

My research activity aims at supporting decisions in occupational health, a domain in which the company that co-funds the research activity operates. One strategy to obtain this decision support system consists of early marker identification of work-related diseases. During this first PhD year, I brought up the following topics:

o _Occupational medicine: at the beginning of this work, it has been important for me to understand how the whole Occupational health world works. The goal of occupational health is to guarantee workers' health status in the workplace during their working time (in other words, the work mansion must not worsen worker's health). To do this, medicine and safety have to go at the same pace in the work world: in Italy, with the Dlgs 81/08, designing a health protocol became mandatory. The health protocol, composed by the occupational doctor, includes medical assessments for workers and the risk assessment document (DVR). With the health protocol, each mansion is associated to a list of specific medical assessments (blood exam, specialistic exam,_

vaccination …), in compliance with the related risks identified in the DVR. Based on the knowledge of the health protocol and the results of the medical assessments provided by the company, a data model has been. In this model, each medical assessment has been selected as a feature, while the knowledge of the health protocol has been useful to evaluate the missing values in the correct way, giving the missing values the right weights. In addition, it has been necessary for me to enhance my knowledge of all the medical features and improve my domain knowledge, in order to implement the right pre-processing operations and build synthetic features to support the analysis (like the "Transaminase" column that is the result of the join of "GOT/AST" and "GPT/ALT" features).

- o *Work-related: the first application field that I have considered to identify early markers of work-related disease has been the **work-related stress**. The choice of work-related stress was made because stress is a widespread pathology in the world population, is hard to diagnose, and only in the last decades it has been the object of academic researches. [1],[2],[3],[4] and other works, have been analyzed in the state-of-the-art phase, and used to produce two diagrams, reported in* Figure 2 *and* Figure 2*, which contain, respectively, the causes and the effects, and the symptoms of work-related stress. This kind of activity requires to cross both psychological and physical information of each subject. Hence, the idea was to do a retrospective analysis of the partner data, connecting the results coming from the medical assessments with the psychological data. The case study proposed by the company, involving data collected in the context of maritime industry, has resulted not to be significant enough to allow the kind of analysis I had envisaged. In particular, it was impossible to join the physical information, obtained in the form of medical records, with the psychological information, obtained with an anonymized survey to which only a very reduced sample of employees has been selected. Due to this, this research field has been suspended, with the hope to organize an RCT in the next years.*

- o *Causal Discovery and Analysis: Causal discovery aims to infer the cause-effect relationships between variables. Using causal analysis, it's possible to do, on observational data, two different analyses:*

  - o *Retrospective analysis: the goal of this analysis is to understand, using information on events that have happened in some conditions, what would have happened under different conditions. In my research, this analysis is useful because allows us to identify the disease effects on the same individual changing the condition.*

  - o *Prospective analysis: This analysis looks for the outcome, like the development of a disease, during a period, and relates this outcome with other factors like risk factors. In my research, this analysis is useful to identify the inclination risk of a new worker.*

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[1] Kivimäki M, Kawachi I. ***Work Stress as a Risk Factor for Cardiovascular Disease***. Curr Cardiol Rep. 2015 Sep;17(9):630. doi: 10.1007/s11886-015-0630-8. PMID: 26238744; PMCID: PMC4523692

[2] Nkurikiyeyezu, Kizito & Yokokubo, Anna & Lopez, Guillaume. (2020). **Effect of Person-Specific Biometrics in Improving Generic Stress Predictive Models. Sensors and Materials**. 32. 703-722. 10.18494/SAM.2020.2650

[3] Holmgren K, Sandheimer C, Mårdby AC, Larsson ME, Bültmann U, Hange D, Hensing G. Early identification in primary health care of people at risk for sick leave due to work-related stress - study protocol of a randomized controlled trial (RCT). BMC Public Health. 2016 Nov 25;16(1):1193. doi: 10.1186/s12889-016-3852-9. PMID: 27884137; PMCID: PMC5123395.

[4] S. Elzeiny and M. Qaraqe, "Blueprint to Workplace Stress Detection Approaches," 2018 International Conference on Computer and Applications (ICCA), Beirut, Lebanon, 2018, pp. 407-412, doi: 10.1109/COMAPP.2018.8460293

For this reason, causal discovery and analysis are the methodologies that I would use to identify early markers of work-related disease.

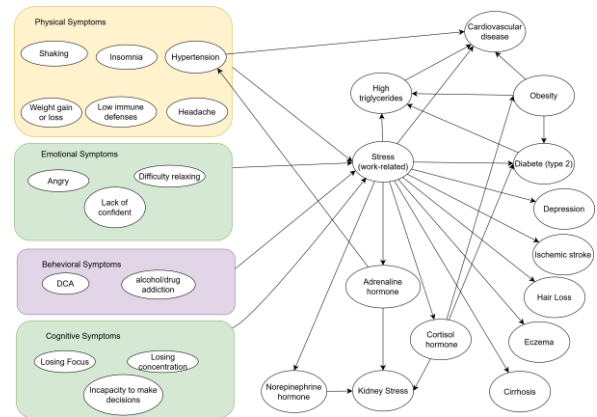
Figure 2. Causes and Effects of work-related stress.

Figure 2 Symptoms of work-related stress.

4. Research products:

One research article is under preparation reporting about the analysis, via machine learning, of maritime work-related disease data.

5. Conferences and seminars attended

6. Activity abroad:

7. Tutorship