UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

DOTTORATO DI RICERCA / PHD PROGRAM IN
INFORMATION TECHNOLOGY AND ELECTRICAL ENGINEERING

Activities and Publications Report

PhD Student: Patrizia Quaranta

Student DR number: DR996635

PhD Cycle: XXXVIII
PhD Chairman: Prof. Stefano Russo

PhD program student's start date: 01/11/2022
PhD program student's end date: 31/10/2025

Supervisor: Roberto Pietrantuono

e-mail: roberto.pietrantuono@unina.it

Co-supervisor: Giuseppe Cascone

e-mail: giuseppecascone@cmlvesuvio.com

PhD scholarship funding entity:
PNRR DM. 352, Mis.: I.3.3 Dottorati innovativi
Company partner: CML VESUVIO s.r.l., Nola (NA)

General information

Patrizia Quaranta received in year 2022 the Master Science degree in Computer Engineering from the University of Napoli Federico II. She attended a curriculum Computer Engineering within the PhD program in Information Technology and Electrical Engineering. She received a grant from Ministry of University and Research (MUR) under "PNRR DM. 352 Mis.: I.3.3 Dottorati innovativi", and from the company partner CML VESUVIO s.r.l. .

Study activities

Attended Courses

Year	Course Title	Type	Credits	Lecturer	Organization
1st	Using Deep Learning Properly	Ad hoc course	4	Prof. Andrea Apicella	ITEE
1st	Scientific Programming And Visualization with Python	Ad hoc course	2	Prof Alessio Botta	DIETI
1st	How to Boost Your PhD	Ad hoc course	4	Prof.ssa Antigone Marino	Polytechnic School
1st	Virtualization and their Technologies	Ad hoc course	5	Prof. Luigi De Simone	ITEE
1st	Statistical Data Analysis	Ad hoc course	4	Prof. Roberto Pietrantuono	ITEE
1st	Trasformazione Digitale	Ad hoc course	3	Prof. Francesco Tortorelli, AgID	ITEE
1st	Scienza Moderna e Disciplina Giuridica dell'Intelligenza Artificiale	Ad hoc course	6	Prof Lucio Franzese	ITEE
1st	Academic Entreprenuership	Ad hoc course	4	Prof. Pierluigi Rippa	Polytechnic School
2nd	Strategic Orientation for STEM Research & Writing	Ad hoc course	5	Dr Chie Shin Fraser	ITEE
2rd	Machine Learning for Science and Engineering Research	Ad hoc course	5	Prof. Anna Corazza	Polytechnic School

Attended PhD Schools

Year	School title	Location	Credits	Dates	Organization
1st	SIESTA2023	Lugano, CH	3	13/09/2023	Università della Svizzera italiana

Attended Seminars

Year	Seminar Title	Credits	Lecturer	Lecturer affiliation	Organization
1st	La nuova sfida delle Quantum Technologies per l'ecosistema dell'innovazione e della ricerca campano"	0.6	Corrado Panzieri	The European House - Ambrosetti	The European House - Ambrosetti
1st	Threat Hunting & Incident Response	0,4	Group-IB	Group-IB	Prof Simon Pietro Romano (DIETI)
1st	Is Control a problem solved for Aerial Robotics Research?	0,2	Prof Antonio Franchi	University of Twente	Prof. Fabio Ruggiero (DIETI)
1st	Embrancing Data Imperfections Via Domain Enriched Visual Task Learning	0,2	Prof Vishal Monga	Pennysilvania State University, USA	Prof. Antonio De Maio (DIETI)
1st	Algorithm Unrolling: Efficient, Interpretable Deep Learning for Signal and Image Processing	0,2	Prof Vishal Monga	Pennysilvania State University, USA	Prof. Antonio De Maio (DIETI)
1st	Multi-robot Control of Heterogeneous Herds	0,2	Edoardo Montijano	Universidad de Zaragoza, Spain	Scuola Superiore Meridionale
1st	NTD in contesto aeronautico	0,2	Cap. G.A.r.n. Ing Giovanni Gravina, PhD	10° Reparto Manutenzione Velivoli	Prof Carlo Forestiere (DIETI)
1st	Analysis and control of functional brain networks	0,2	Prof. Fabio Pasqualetti	University of California at Riverside- USA	Scuola Superiore Meridionale
1st	Artificial Intelligence for Defense Seabed-to Space Situational Awareness	0,2	Dr. Paolo Braca	NATO Science and Technology Organization	Prof. Antonio De Maio (DIETI)
1st	CARE-CRUI "open access with IEEE" webinar	0,3	Nino Grizzuti, Eszter Luckacs, Stefano Bianco	CARE-CRUI and Unina, IEEE, CARE-CRUI and INFN	CARE-CRUI and IEEE
1st	Enhancing quit readout with Bayesian Learning	0,2	Dr. Nicola Lo Gullo	Università della Calabria	Prof. Vincenzo D'ambrosio (Dipartimento di Fisica)
1st	Symbiotic Control of Wearable Soft Suits for human motion	0,4	Prof. Lorenzo Masia	Institut für Technische Informatik (ZITI)	Prof Fanny Ficuciello (DIETI)

	assistance and augmentation			Heidelberg University, Germany	
1st	Open-source software e sicurezza della software supply chain	0,4	Antonino Sabetta, Serena Ponta	SAP	Prof. Roberto Natella (DIETI)
1st	Traffic Engineering with Segment Routing: optimally dealing with most popular use-cases	0,2	Prof. Pascal Merindol	University of Strasbourg – France	Dr. Valerio Persico (DIETI)
1st	2nd Generation of Mobile EEG Systems: Hands-on Experience	0,2	Dr. Andrija Dakovic	Manager of mBrainTrain	Prof. Pasquale Arpaia (DIETI)
1st	Exploring Advanced Aerial Robotics: A Journey into Cutting-Edge Projects and Neural Control	0,2	Eng. Eugenio Cuniato	Autonomous System Lab - ETH Zürich	Dr. Julien Mellet (DIETI)
1st	Models of human motor coordination – a critical assessment and some open problems	0,2	John Hogan	Senior Research Fellow at the University of Bristol - UK	Scuola Superiore Meridionale
1st	BGP & Hot-Potato Routing: graceful and optimal convergence in case of IGP events	0,2	Prof. Pascal Merindol	University of Strasbourg – France	Dr. Valerio Persico (DIETI)
1st	Ricerca e formazione nella società della transizione digitale	1			CINI
1st	A cosa servono le riviste?	0,3			Springer Nature
2nd	Economic Fitness: Concepts, Methods and Applications	0.2	Scuola Superiore Meridionale	External seminar at the University of	University of Napoli Federico II
2nd	Roadmaps for AI integration in the Rail Sector (RAILS)	0.3	Lorenzo De Donato	Phd Student ITEE-DIETI	Prof. Valeria Vittorini
2nd	Energy-Efficient Data Science	0.2	dr. Carlos Ordonez	University of Houston	Prof. Elio Masciari
2nd	The Generative Power of Deep Learning: Variational Auto-Encoders and Generative Adversarial Networks for scenario generation	0.5	Prof. Enza Messina	Universitò di Milano Bicocca	Beniamino Di Martino (Università della Campania "Luigi Vanvitelli")
2nd	Multi-agent autonomous flight at Leonardo Labs	0.2	Fabrizio Schiano		
2nd	Hominis	1	Prof Tarry Singh, Dr. Giuseppe Fiameni, Dr.	Prof. Tarry Singh CEO @ Real.AI, The Netherlands, Dr. Giuseppe Fiameni	Prof Carlo Sansone, (DIETI) Prof Stefano Marrone (DIETI)

			Michela Prof. Tuozzo, Guglielmo Tamburrini, Prof. Stefano Marrone	Data Scientist and AI consultant @ NVIDIA, Italy, Dr. Michela Tuozzo Researcher in Constitutional Law, Department of Law, UniNa, Italy, Prof. Guglielmo Tamburrini Professor of Philosophy of Science, DIETI, UniNa, Italy	
2nd	Fair Workshops 2024. Spoke 3: Resilient AI	1.2		FAIR - Future Artificial Intelligence Research	Prof Carlo Sansone (DIETI)
2nd	Analytic center selection of optimization-based controllers for robot ecology	0.2	Prof. Gennaro Notomista	University of Waterloo, Waterloo, Canada	Prof Bruno Siciliano (DIETI)
2nd	Exploring the Frontiers of Modern Cryptography	0.3	Prof. Antonis Michalas	Tampere University, Finland	Prof Simon Pietro Romano (DIETI)
2nd	IEEE Authorship and Open Access Symposium	0.4	Dr. Petar Popovski	Aalborg University, Denmark	IEEE
2nd	REGOLAZIONE IN TEMA DI INTELLIGENZA ARTIFICIALE ALLA LUCE DELL'AI ACT	1	Dr. Elvira Raviele	Dirigente Ufficio di Gabinetto MIMIT	5g Academy's / Prof. Antonia Tulino (DIETI)
2nd	Sustainable IT: Strategies and Best Practices for a Green Engineering Future	1	Annalisa Di Leva, Dimitri Cuomo, Benedetta Ramazzotti, Tiziano Marcozzi	Capgemini	5g Academy's / Prof. Antonia Tulino (DIETI)
2nd	Social Network Analysis: Methods and Applications	0.4	Prof. Tanmoy Chakraborty	IIIT-Delhi, Delhi, India	Prof. Giancarlo Sperlì (DIETI)
2nd	Introduction to Large Language Models: Evolution and the current state	0.4	Prof. Tanmoy Chakraborty	IIIT-Delhi, Delhi, India	Prof. Giancarlo Sperlì (DIETI)
2nd	Real-time Resource Management for Adaptive Embedded Systems and Applications	0.2	Prof. Dipl.-Ing. Dr. Gerhard Fohler	Chair of Real-Time Systems Technical University of Kaiserslautern, Germany	Prof Marcello Cinque (DIETI)

2nd	On the Single Allocation hub location problems: New formulations and Solving Methods	0.2	Prof. A.M. Rodríguez-Chía	University of Cadiz, Cadiz, Spain	Prof Maurizio Boccia (DIETI)
2nd	Using support vector machines for feature selection and outlier detection	0.2	Prof. Marta Baldomero-Naranjo	University of Cadiz, Cadiz, Spain	Prof Maurizio Boccia (DIETI)
2nd	Resource management and orchestration for mixed-criticality cloud/distributed systems	0.2	Dr-Ing. Gautam Gala	Technical University of Kaiserslautern, Germany	Prof Marcello Cinque (DIETI)
2nd	From ACE Technologies to Sustainable, Accessible and Equitable Urban Mobility: An Optimization Journey	0.4	Prof. Mauro Salazar	Eindhoven University of Technology, Eindhoven, Netherland	Prof. Stefania Santini (DIETI)
3rd	Perché l'Intelligenza Artificiale crede di fare a meno della teoria linguistica, ma in realtà non potrà farlo	0.4	Prof. Alessandro Lenci	Università di Pisa	Phil_AI Lab - prof. F. Cutugno DIETI - Unina
3rd	AI and Enabling Technologies for Social Robots	0.4	Prof.ssa Silvia Rossi	DIETI	Phil_AI Lab - prof. F. Cutugno DIETI - Unina
3rd	Shapling Robustly control loop: look into stability margins & uncertainties	0.2	prof Michael Ruderman/ C. Visone		
3rd	Strutture basate su regole e strutture basate su approssimazioni	0.3	prof. Antonio Lieto	Università di Salerno	Phil_AI Lab - prof. F. Cutugno DIETI - Unina
3rd	Can we Rely on AI? Reliability Issues in Artificial Neural Networks and Potential Solutions for Autonomous Vehicles	0.2	Prof. Paolo Rech/Dr Edoardo Giusto	University of Trento, Trento, Italy	Dr. Edoardo Giusto
3rd	Emergent behaviors and collective decisions in cyber-physical-human systems	0.2	Prof. Karl H. Johansson	KTH Royal Institute of Technology, Stockholm, Sweden	Scuola Superiore Meridionale
3rd	Dynamic Risk Assessment in Industrial Applications: Leveraging Bayesian Inference for Enhanced Decision-Making	0.2	Prof Simone Guarino	University Campus Bio-Medico of Rome,	Dr. Francesco Vitale (DIETI)
3rd	5G & DIGITAL	0.8	Dr. Maurizio	Director of	5g Academy's / Prof.

	TRANSFORMATION: A VIEW FROM AN UNCONVENTIONAL PERSPECTIVE		Irlando	Information Technology Noovle, a TIM Enterprise brand	Antonia Tulino (DIETI)
3rd	On the Security of Semantic Watermarking to Detect AI-Generated Content	0.2	Dr. Erwin Quiring	Ruhr University Bochum, Germany, and ICSI @ UC Berkeley	Prof. Luisa Verdoliva (DIETI)

Research activities

Patrizia Quaranta's research activity focuses on the development of a framework for the causal analysis of structured health data, designed to integrate data analytics, machine learning, and causal inference methods. The framework defines a complete pipeline for the **construction, validation, and interrogation of causal models**, combining statistical validation and causal reasoning to improve the interpretation of complex health phenomena.

The proposed methodology includes data preprocessing, feature importance analysis, and association rule mining for variable selection and pattern discovery. Causal discovery and causal inference techniques are then applied to extract causal models, which are validated through interventional and counterfactual queries. This process enables the evaluation of the potential effects of new health protocols and the assessment of causal relationships in observational data.

The framework has been applied and validated in two different domains: **occupational health**, where it was used to identify early markers of work-related conditions, and public health, through an epidemiological study on **diabetes prevention**. These applications demonstrate the flexibility and general applicability of the framework across multiple health contexts, supporting evidence-based decision-making and the development of safer and more effective health interventions.

Tutoring and supplementary teaching activities

Credits summary

PhD Year	Courses	Seminars	Research	Tutoring / Supplementary Teaching
1st	35	6	24	-
2nd	10	8.5	40.9	-
3rd	-	2.9	57.1	-
Total	45	17.4	122	-

Research periods in institutions abroad and/or in companies

PhD Year	Institution / Company	Hosting tutor	Period	Activities
1st	CML VESUVIO s.r.l., Nola (NA)	Giuseppe Cascone	3 months	Introduction to occupational medicine and workplace safety. Study on work-related Stress
2st	CML VESUVIO s.r.l., Nola (NA)	Giuseppe Cascone	7 months	Analysis of data from company-administered fitness-for-work medical examinations. Identification of key factors influencing fitness-for-duty eligibility. Preparation of paper "Correlation and Causal Analysis of Occupational Health Data in the Maritime Domain"
3st	CML VESUVIO s.r.l., Nola (NA)	Giuseppe Cascone	2 months	Preparation of paper "Correlation and Causal Analysis of Occupational Health Data in the Maritime Domain"
3st	University of Thessaly, Medical School, Laboratory of Hygiene and Epidemiology, Larisa, Greece	prof. Barbara Mouchtouri.	6 months	Understanding the modes of transmission of gastrointestinal influenza (GI). Analysis of GI data.

PhD Thesis

Healthcare research increasingly relies on data-driven methodologies to support clinical decision-making while avoiding expensive, hard-to-implement and sometimes unethical, controlled trials. However, traditional Machine Learning models are primarily based on statistical correlations and often fail to provide an understanding of the underlying causal relationships. In a context where interventions directly affect human well-being, purely correlational approaches may be insufficient. Causal Reasoning enables the estimation of intervention effects and counterfactual scenarios from observational data, offering a more interpretable and action-oriented perspective. Nevertheless, its application to real-world clinical data remains challenging due to data heterogeneity, incompleteness, and the lack of prior causal knowledge.

This thesis addresses these challenges by proposing a framework for causal discovery and inference from observational clinical data. The framework integrates data pre-processing, feature selection through machine learning techniques, causal structure discovery, validation using Large Languages Models, and statistical verification procedures to assess robustness. The resulting causal model supports both interventional and counterfactual queries, allowing the simulation of clinical protocols or therapeutic modifications before their real-world implementation.

The methodology was validated through two case studies. The first focuses on diabetes mellitus, using the PIMA Indians Diabetes dataset to evaluate the impact of lifestyle-related interventions. The second applies the framework to occupational health in the maritime sector, using real-world data collected from two shipping companies. In both cases, the inferred causal relationships align with clinical evidence and support what-if scenario analysis.

Overall, the results highlight the potential of causal reasoning as a bridge between predictive modeling and clinical interpretability, providing a realistic and interpretable methodology to support safer and more informed medical decision-making.

Research products

List of scientific publications

International conference papers

P. Quaranta, R. Pietrantuono and G. Cascone, "Correlation and Causal Analysis of Occupational Health Data in the Maritime Domain", *2025 IEEE 13th International Conference on Healthcare Informatics (ICHI)*, Rende, Italy, 2025, pp. 739-744, doi: 10.1109/ICHI64645.2025.00112.

P. Quaranta and R. Pietrantuono, "Exploring Causal Modeling to Enhance Diabetes Prediction and Management," *2025 IEEE 38th International Symposium on Computer-Based Medical Systems (CBMS)*, Madrid, Spain, 2025, pp. 725-726, doi: 10.1109/CBMS65348.2025.00150.

Patents and/or spin offs

Neither patents nor spin-offs were developed.

Date 27/10/2025

PhD student signature Patrizia Quaranta

Supervisor signature