
UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

**DOTTORATO DI RICERCA / PhD PROGRAM IN
INFORMATION TECHNOLOGY AND ELECTRICAL ENGINEERING**

Activities and Publications Report

PhD Student: **Massimo Rosamilia**

Student ID: DR993897

PhD Cycle: XXXV

PhD Cycle Chairman: Prof. Stefano Russo

PhD program student's start date: 01/11/2019

PhD program student's end date: 30/11/2022

Supervisor: Prof. Antonio De Maio

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PhD scholarship funding entity:

Università Federico II

General information

Massimo Rosamilia received in 2019 the Master Science degree in Computer Engineering from the University of Salerno. He attended a curriculum in Radar Signal Processing within the PhD program in Information Technology and Electrical Engineering. He received a grant from Università Federico II.

Study activities

Attended Courses

Year	Course Title	Type	Credits	Lecturer	Organization
1 st	Scientific Programming and Visualization with Python	Ad hoc course	2	Prof. Alessio Botta	DiSt department - Scuola Politecnica e delle Scienze di Base - UNINA
1 st	Matlab Fundamentals	Ad hoc course	2	Prof. Agostino De Marco, with: Dr. Stefano Marrone, Dr. Francesco Orefice	DIETI and Scuola Politecnica e delle Scienze di Base - UNINA
1 st	Virtualization technologies and their applications	Ad hoc course	4	Dr. Luigi De Simone	Prof. D. Cotroneo, DIETI - University of Napoli Federico II
1 st	Innovation management, entrepreneurship and intellectual property	Ad hoc course	5	Prof. Pierluigi Rippa	Prof. Pierluigi Rippa - StartCup Campania 2020
1 st	Tecniche Di Elaborazione Dei Segnali Per La Bioingegneria	MSc course	9	Prof. Antonio De Maio, Dr. Vincenzo Carotenuto	University of Napoli Federico II
1 st	Strategic Orientation for STEM Research & Writing	Ad hoc course	3.6	Chie Shin Fraser	ITEE - ICTH
2 nd	Sistemi Radar	MSc course	9	Prof. Antonio De Maio	University of Napoli Federico II
2 nd	Radiolocalizzazione Terrestre e Satellitare	MSc course	9	Prof. Augusto Aubry	University of Napoli Federico II
2 nd	Cooperative and Non Cooperative Localization Systems	Ad hoc course	3	Proff. Antonio De Maio, Augusto Aubry, Dr. Vincenzo Carotenuto	University of Napoli Federico II
3 rd	Software Defined Radio Applications for Radar and Localization Systems	Ad hoc course	3	Dr. Vincenzo Carotenuto	University of Napoli Federico II

Attended PhD Schools

Year	School title	Location	Credits	Dates	Organization
1 st	Intelligenza Artificiale ed Etica: La ricerca in IA alla prova delle sfide etiche	Napoli, Italy	1.2	06/12/2019	University of Naples Federico II
1 st	NVIDIA DLI Workshops 2019: Deep Learning for Computer Vision: Classification, Segmentation, and Recognition	Napoli, Italy	0.5	16/12/2019	University of Napoli Federico II and NVIDIA
1 st	2020 IEEE Radar Conference Radar Summer School	Firenze, Italy	2	21-25/09/2020	IEEE

Attended Seminars

Year	Seminar Title	Credits	Lecturer	Lecturer affiliation	Organization
1 st	Marked Point Processes For Object Detection And Tracking In High Resolution Images: Application To Remote Sensing Data	0.2	Prof. Josiane Zerubia	Université Côte d'Azur	University of Napoli Federico II
1 st	Cybersecurity and fuzzing for robots, blockchain, and more,	0.2	Prof. Dr. Antonio Ken Iannillo	University of Luxembourg	University of Napoli Federico II
1 st	Computational Biology: Large scale data analysis to understand the molecular bases of human diseases	0.2	Prof. Michele Ceccarelli	University of Napoli Federico II	University of Napoli Federico II
1 st	Deep Learning for Radar and Communications	0.2	Rick Gentile	Mathworks	Mathworks
1 st	Elettromagnetismo e salute	0.2	Prof. Rita Massa	University of Napoli Federico II	University of Napoli Federico II
1 st	Model, Simulate, and Test 5G NR PHY in MATLAB	0.2	Marc Barberis	Mathworks	Mathworks
1 st	Access the eLearning library on IEEE Xplore	0.2	Eszter Lukacs	IEEE	IEEE
1 st	Large Scale Training of Deep Neural Networks	0.4	Giuseppe Fiameni	NVIDIA	NVIDIA
1 st	La programmazione europea e la ricerca. Nuovi scenari della programmazione europea	0.4	Filippo Ammirati	ENEA	Università degli Studi di Napoli Federico II in collaborazione con TecUp

Activities and Publications – Final Report

UNINA PhD in Information Technology and Electrical Engineering – XXXV Cycle

PhD candidate: Massimo Rosamilia

	dopo il 2020. La gestione di un progetto di ricerca				
1 st	Health 4.0 – La rapidità della medicina e la velocità del cambiamento del nostro mondo	0.4	Paolo Netti	University of Napoli Federico II	University of Napoli Federico II
1 st	Realtà Virtuale e salute reale. Health 4.0 – Dal bit alla mente: spazi virtuali per la salute	0.5	Valentino Megale	TecUp	TecUp
1 st	Planning 5G under EMF constraints: challenges and opportunities	0.4	Prof. Luca Chiaraviglio	University of Rome Tor Vergata	University of Napoli Federico II
1 st	Joint Design of Optics and Post-Processing Algorithms Based on Deep Learning for Generating Advanced Imaging Features	0.4	Dr. Raja Giryes	Tel Aviv University	IEEE SPS Computational Imaging Webinar Series Signal Processing And Computational image formation (SPACE)
1 st	Virtual seminars on sensing with nano-devices	0.8	J. Wenger, C. Rockstuhl, L. Baldassarre, M. Fleischer	Plasmonica & Nano-Ottica community	Plasmonica & Nano-Ottica community
1 st	Bias from the wild	0.4	Prof. Nello Cristianini	University of Bristol	Associazione Italiana per la ricerca in Computer Vision, Pattern recognition e machine Learning (CVPL)
1 st	Adversarial Attacks On Image Classifiers	0.4	Prof. Andrea Cavallaro	Queen Mary University of London	Associazione Italiana per la ricerca in Computer Vision, Pattern recognition e machine Learning (CVPL)
1 st	Noninvasive Mapping of Electrical Properties using MRI	0.3	Prof. Riccardo Lattanzi	New York University	University of Napoli Federico II
1 st	Exploring Autonomy in Robotic Flexible Endoscopy	0.4	Pietro Valdastrì	University of Leeds	Prof. Fanny Ficuciello, DIETI - University of Napoli Federico II
1 st	Learning Representations And Geometry From Unlabelled Videos	0.4	Prof. Andrea Vedaldi	University of Oxford	Associazione Italiana per la ricerca in Computer Vision,

Activities and Publications – Final Report

UNINA PhD in Information Technology and Electrical Engineering – XXXV Cycle

PhD candidate: Massimo Rosamilia

					Pattern recognition e machine Learning (CVPL)
1 st	“Linear regression in PyTorch” and “Convolutional Neural Networks”.	0.4	Dr. Christian Hundt	NVIDIA	NVIDIA
1 st	Algorithmic Accountability - Affidabilità e responsabilità degli algoritmi	0.4	Joshua A. Kroll	Naval Postgraduate School, Monterey, CA	Fondazione Ugo Bordoni
1 st	Radar Conference Virtual Summer School (10 hours of lectures)	2	IEEE AESS Radar Summer School	IEEE	IEEE AESS Radar Summer School
2 nd	Science, Reality and Credibility. Il ruolo del pensiero scientifico per contrastare la disinformazione e affrontare le grandi sfide del future	0.3	Sette Università della Campania	Sette Università della Campania	Fondazione Idis-Città della Scienza
2 nd	AI4NETS – AI/ML for data communication Networks	0.6	Dr. Pedro Casas	AIT Austrian Institute of Technology	AIT Austrian Institute of Technology
2 nd	How to get published with the IEEE	0.3	Eszter Lukacs	IEEE	IEEE
2 nd	Subclonal reconstruction of tumor architectures by using machine learning and population genetics	0.3	Giulio Caravagna	University of Trieste	Prof. Michele Ceccarelli
2 nd	1st International Virtual School on Radar Signal Processing (10 hours of lectures)	2	n/a	University of Electronic Science and Technology of China (UESTC)	University of Electronic Science and Technology of China (UESTC)
2 nd	From Photometric Redshifts to Improved Weather Forecasts an interdisciplinary view on machine learning	0.2	Kai Polsterer	Heidelberg Institute for Theoretical Studies - HITS	University of Napoli Federico II
2 nd	Tensor Completion from Regular Sub-Nyquist Samples	0.2	Yuejie Chi	Carnegie Mellon University, USA	IEEE SPS Sensor Array and Multichannel Technical Committee (SAM TC)
2 nd	AI: Artificial Intelligence for notary's sector - a case study	0.2	Salvatore Palange	FLUEL (Innovation for Business)	University of Napoli Federico II
2 nd	Advances in Machine	0.2	Gustau	University of	IEEE Geoscience and

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UNINA PhD in Information Technology and Electrical Engineering – XXXV Cycle

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	Learning for Modelling and Understanding in Earth Sciences		Camps	Valencia	Remote Sensing South Italy Chapter
2 nd	Machine learning: Causality lost in translation	0.3	Edwin A. Valentijn	University of Groningen	University of Napoli Federico II
2 nd	Approaches to Graph Machine Learning	0.2	Miroslav Y. Cepek	Czech Technical University in Prague	University of Napoli Federico II
2 nd	Visual Interaction and Communication in Data Science	0.4	Marco Quartulli	Vicomtech (Spagna)	University of Napoli Federico II
2 nd	Robo Ludens: A game design taxonomy for human-robot interaction	0.2	Dr. John Edison Muñoz Cardona	University of Waterloo, Canada	University of Napoli Federico II
2 nd	Dai mainframe all' IoT: una retrospettiva sull'evoluzione delle architetture di calcolo	0.4	Antonino Mazzeo	University of Napoli Federico II	University of Napoli Federico II
2 nd	Towards Neural Signal Processing and Imaging	0.2	Prof. Se Young Chun	Seoul National University	IEEE Signal Processing Society
2 nd	Big data and Computational Linguistics	0.4	Francesco Cutugno	University of Napoli Federico II	University of Napoli Federico II
2 nd	6G: A New Frontier for the Design of NOMA	0.2	Dr. Zhiguo Ding	Princeton University	IEEE Signal Processing Society
2 nd	Sensoria Health	0.2	Stefano Rossotti	Sensoria Health Inc	University of Napoli Federico II
2 nd	CFAR Techniques for Radar Detection	0.2	Antonio De Maio	University of Napoli Federico II	IEEE Aerospace & Electronic Systems Society
2 nd	The Role of Multitarget Tracking Radar in Surveillance Systems	0.2	Alfonso Farina	-	IEEE Aerospace & Electronic Systems Society
2 nd	Advanced Topics in Radar Signal Processing	1.6	Alfonso Farina	-	University of Napoli Federico II
2 nd	L'esposizione ai campi elettromagnetici generati dal sistema 5G - Metodologie scalari e vettoriali di misura dell'esposizione e tecniche di estrapolazione	0.8	Sara Adda, Daniele Franci, Settimio Pavoncello	ARPA Piemonte e ARPA Lazio	University of Napoli Federico II
3 rd	Designing Quantum Algorithms	0.4	Michele Amoretti	University of Parma	University of Napoli Federico II
3 rd	Modeling Physical Structure and Dynamics Using Graph-Based Machine Learning	0.2	Peter Battaglia	DeepMind	IEEE Signal Processing Society
3 rd	Bayesian Multi-object	0.2	Ba-Ngu Vo	Curtin University	IEEE Signal Processing

	Tracking: Probability Hypothesis Density Filter and Beyond				Society
3 rd	RAILS MID-TERM WORKSHOP	1	Chair: Zhiyuan Lin	Univ. Leeds	RAILS
3 rd	Learning by Transference in Large Graphs	0.2	Alejandro Ribeiro	University of Pennsylvania	IEEE Signal Processing Society
3 rd	Graph Neural Networks are Dynamic Programmers	0.2	Petar Velicković	Deepmind	IEEE Signal Processing Society
3 rd	Electronic Attack and Antenna Based Countermeasures	0.2	Antonio De Maio	University of Napoli Federico II	IEEE Aerospace & Electronic Systems Society

Research activities

Massimo Rosamilia took part in the research on adaptive simultaneous detection/estimation for radar signal processing, on robust detection/estimation techniques in the presence of missing data (employing the Expectation-Maximization algorithm) or accounting for the mutual coupling between the radiating elements of the antenna array (using advanced optimization techniques to estimate the coupling coefficients as well as the target and noise parameters). He also participated in the development of target estimation techniques for FDA-MIMO radars and adaptive detection strategies for full polarimetric FDA-MIMO architectures. Besides, he carried out the measurement of drones radar cross section and their statistical analysis in order to investigate the actual performance of standard radar systems in detecting such objects, which are characterized by RCS with strong fluctuations in angle. In addition, he participated in devising new radar sensing schemes employing meta-surfaces in order to extend the detection capabilities of modern radars in particularly challenging scenarios.

During the mentioned researches, Massimo Rosamilia contributed to the study and implementation of iterative procedures for solving the optimization problems involved in the proposed strategies, such as the Dinkelbach algorithm, the Coordinate Descent method, the Projected Gradient method, and the Maximization-Minimization algorithm, providing both formal proofs on their convergence properties as well as the analytical expression of the resulting computational complexity. In his research, Massimo Rosamilia also made essential contributions to the development of numerical integration and simulation techniques based on Monte Carlo method.

Tutoring and supplementary teaching activities

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Credits summary (total credits: 212.7)

PhD Year	Courses	Seminars	Research	Tutoring / Supplementary Teaching
1 st	27.3	9.4	35	0
2 nd	21	9.6	45	0
3 rd	3	2.4	60	0

Research periods in institutions abroad and/or in companies

PhD Year	Institution / Company	Hosting tutor	Period	Activities
2 nd	Cranfield University, Shrivenham, U.K.,	Alessio Balleri, Reader in Radar Systems	23/09/2021 – 5/11/2021	Lab measurements of Radar Cross Section (RCS) of five Unmanned Aerial Vehicles (UAVs) and their statistical analysis
3 rd	University of Luxembourg, Luxembourg, Luxembourg	Bhavani Shankar, Assistant professor	15/09/2022 – 17/12/2022	On-field experiments to examine the effects of power amplifiers on radar waveforms using USRP devices.

PhD Thesis

In the PhD Thesis, Massimo Rosamilia addressed the development of specific advanced algorithms for radar signal processing, presenting theoretical contributions such as joint target detection and estimation architectures, innovative strategies to recover performance in missing-data scenarios, novel signal processing methods developed for FDA-MIMO radars (also exploiting the polarimetric domain). The PhD Thesis is organized into 7 chapters and 6 appendices. Chapter 1 provides an overview of the state of the art of modern multichannel radar systems and highlights some relevant problems of practical interest. Chapter 2 deals with the problem of joint radar target detection and angle estimation. Chapter 3 presents the problem of estimating a structured covariance matrix under the missing-data context. In Chapter 4, leveraging the results proposed in Chapter 3, the problem of detecting a prospective target embedded in Gaussian interference with an unknown (but possibly structured) covariance matrix is addressed for a missing-data context. Chapter 5 investigates the problem of joint target angle and incremental range estimation using a FDA-MIMO radar in a background of Gaussian interference with known spectral properties. Starting from the framework proposed in Chapter 5, Chapter 6 deals with the target detection problem with a polarimetric FDA-MIMO radar. Chapter 7 summarizes the theoretical advancements described in this thesis work and highlights emerging trends and issues to be addressed in the immediate future.

Publications

Research results appear in 6 papers published in international journals (2 further journal papers are currently under review) and 5 contributions to international conferences (1 further conference has been presented, although it is not currently available).

List of scientific publications

International journal papers

A. Aubry, A. De Maio, S. Marano, and M. Rosamilia,
Single-Pulse Simultaneous Target Detection and Angle Estimation in a Multichannel Phased Array Radar
IEEE Transactions on Signal Processing
vol. 68, pp. 6649- 6664, 2020, doi: 10.1109/TSP.2020.3039883.

L. Lan, M. Rosamilia, A. Aubry, A. De Maio, and G. Liao,
Single-Snapshot Angle and Incremental Range Estimation for FDA-MIMO Radar
IEEE Transactions on Aerospace and Electronic Systems
vol. 57 (6), pp. 3705-3718, 2021, doi: 10.1109/TAES.2021.3083591.

A. Aubry, A. De Maio, and M. Rosamilia,
Reconfigurable Intelligent Surfaces for N-LOS Radar Surveillance
IEEE Transactions on Vehicular Technology
vol. 70 (10), pp. 10735-10749, 2021, doi: 10.1109/TVT.2021.3102315.

A. Aubry, A. De Maio, S. Marano, and M. Rosamilia,
Structured Covariance Matrix Estimation With Missing-(Complex) Data for Radar Applications via
Expectation-Maximization
IEEE Transactions on Signal Processing
vol. 69, pp. 5920-5934, 2021, doi: 10.1109/TSP.2021.3111587.

A. Aubry, V. Carotenuto, A. De Maio, M. Rosamilia, and S. Marano,
Adaptive Radar Detection in the Presence of Missing-data
IEEE Transactions on Aerospace and Electronic Systems
vol. 58 (4), pp. 3283-3296, 2022, doi: 10.1109/TAES.2022.3147443.

L. Lan, M. Rosamilia, A. Aubry, A. De Maio, G. Liao, and J. Xu,
Adaptive Target Detection with Polarimetric FDA-MIMO Radar
IEEE Transactions on Aerospace and Electronic Systems
Early Access, 2022, doi: 10.1109/TAES.2022.3210887.

International conference papers

M. Rosamilia, A. Aubry, A. De Maio, and S. Marano,
Simultaneous Radar Detection and Constrained Target Angle Estimation via Dinkelbach Algorithm,
2020 IEEE Radar Conference (RadarConf20)
Florence, Italy, Sept. 2020, pp. 1-6, IEEE, DOI: 10.1109/RadarConf2043947.2020.9266380.

M. Rosamilia, A. Aubry, V. Carotenuto, and A. De Maio,
Experimental Analysis of Structured Covariance Estimators with Missing data,
2021 IEEE 8th International Workshop on Metrology for AeroSpace (MetroAeroSpace)
Napoli, Italy, Jun. 2021, pp. 271-276, IEEE, DOI: 10.1109/MetroAeroSpace51421.2021.9511731.

A. Aubry, A. De Maio, and M. Rosamilia,
RIS-Aided Radar Sensing in N-LOS Environment,
2021 IEEE 8th International Workshop on Metrology for AeroSpace (MetroAeroSpace)
Napoli, Italy, Jun. 2021, pp. 271-276, IEEE, DOI: 10.1109/MetroAeroSpace51421.2021.9511765.

M. Rosamilia, L. Lan, A. Aubry, and A. De Maio,
Polarimetric FDA-MIMO Radar Detection,
2022 IEEE Radar Conference (RadarConf22)
New York City, USA, Mar. 2022, pp. 1-6, IEEE, DOI: 10.1109/RadarConf2248738.2022.9764223.

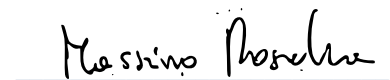
M. Rosamilia, A. Aubry, A. Balleri, V. Carotenuto and A. De Maio,
RCS Measurements of UAVs and Their Statistical Analysis,
2022 IEEE 9th International Workshop on Metrology for AeroSpace (MetroAeroSpace)
Pisa, Italy, Jun. 2022, pp. 179-184, IEEE, DOI: 10.1109/MetroAeroSpace54187.2022.9856394.

Awards and Prizes

- Ranked second in the Student Contest of the 1st International Virtual School on Radar Signal Processing, with the contribution “Simultaneous Radar Detection and Constrained Target Angle Estimation via Dinkelbach Algorithm”.

Date 26/10/2022

PhD student signature



Supervisor signature

