
UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

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

Activities and Publications Report

PhD Student: **Angela Marino**

Student ID: DR993888

PhD Cycle: XXXV

PhD Cycle Chairman: Prof. Stefano Russo

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

PhD program student's end date: 31/10/2022

Supervisor: Augusto Aubry

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Co-supervisor: Paolo Braca

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PhD scholarship funding entity:

NATO Centre for Maritime Research and Experimentation

General information

Angela Marino received the Master Science degree in Telecommunication Engineering in 2019 from the University of Napoli Federico II. She attended a curriculum in Telecommunication within the PhD program in Information Technology and Electrical Engineering. Her PhD studies were supported by NATO Science and Technology Organization Centre for Maritime Research and Experimentation.

Study activities

Attended Courses

Year	Course Title	Type	Credits	Lecturer	Organization
1 st	Intelligenza Artificiale ed Etica: La ricerca in IA alla prova delle sfide etiche	Course	1.4	Dr. Roberto Prevete	DIETI
1 st	Deep Learning for Computer Vision: Classification, Segmentation, and Recognition	Course	0.5	Luigi Troiano	NVIDIA DLI Workshops 2019
1 st	Scientific Programming and Visualization with Python	Course	2	Prof. Alessio Botta	UniNA
1 st	Matlab Fundamentals	Course	2	Prof. Agostino De Marco, Dr. Stefano Marrone, Dr. Francesco Orefice	DIETI and Scuola Politecnica e delle Scienze di Base - UniNA
1 st	Innovation management, entrepreneurship and intellectual property	Course	5	Prof. Pierluigi Rippa	Prof. Pierluigi Rippa - StartCup Campani a 2020
1 st	Machine Learning	Course	4	Marco Aiello, Anna Corazza, Diego Gagnaniello, Francesco Isgrò, Roberto Prevete, Francesco Raimondi, Carlo Sansone	ITEE - ICTH
1 st	Strategic Orientation for STEM Research & Writing	Course	3.6	Chie Shin Fraser	ITEE - ICTH
1 st	Tecniche Di Elaborazione Dei Segnali Per La Bioingegneria	Course	9	Prof. A. De Maio	DIETI, UniNA
2 nd	MSc course – Radiolocalizzazione Terrestre e Satellitare -	Course	9	Prof. Augusto Aubry	DIETI, UniNA
2 nd	Cooperative and Non Cooperative Localization Systems	Course	3	Profs. Augusto Aubry, Antonio De Maio Dr. Vincenzo Carotenuto	DIETI, UniNA

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PhD candidate: Angela Marino

	Aubry, Antonio De Maio Dr. Vincenzo Carotenuto				
2 nd	Matrix Analysis for Signal Processing with MATLAB	Course	2	Prof. Augusto Aubry, Antonio De Maio Dr. Vincenzo Carotenuto	DIETI, UniNA
2 nd	Teoria dell'Informazione	Course	6	Prof. Marco Lops	DIETI, UniNA

Attended PhD Schools

Year	School title	Location	Credits	Dates	Organization
1 st	Radar Summer School	Radar Conference Virtual Summer School	2	19/09/2020 - 16/10/2020	2020 IEEE Radar Conference

Attended Seminars

Year	Seminar Title	Credits	Lecturer	Lecturer affiliation	Organization
1 st	Cybersecurity and fuzzing for robots, blockchain, and more	0.2	Prof. Dr. Antonio Ken Iannillo	University of ...	Roberto Natella
1 st	Deep Learning for Radar and Communications MathWorks	0.2	Rick Gentile	MathWorks	Microwave Journal
1 st	Computational Biology: Large Scale data analysis to understand the molecular bases of human diseases	0.2	Prof. Michele Ceccarelli	University of Naples Federico II	DIETI
1 st	Elettromagnetismo e salute	0.2	Prof Rita Massa	University of Naples Federico II	Prof Rita Massa
1 st	"How to get published with the IEEE?"	0.4	Dr. Paul Henriques	IEEE	Dr.ssa Alessandra Scippa, DIETI
1 st	Access the eLearning library on IEEE Xplore	0.2	Dr. Eszter Lukacs	IEEE	Dr. Eszter Lukacs
1 st	Virtualization technologies and their applications (lesson 1 and 2)	0.4	Dr. Luigi De Simone	University of Naples Federico II	Prof. D. Cotroneo, DIETI
1 st	SAS Analytics	0.4	Dr. Cinzia Gianfiori	SAS Academic Program Manager	SAS Academic Program Manager
1 st	Realtà Virtuale e salute reale. Health 4.0	0.5	Valentino Magale	Softcare Studios Srls	Valentino Magale
1 st	Planning 5G under EMF constraints: challenges and opportunities.	0.4	Prof. Luca Chiaraviglio	University of Rome Tor Vergata	Prof. Luca Chiaraviglio - University of Rome

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					Tor Vergata - Dr.ssa A. Cacciapuoti, Dr. M. Caleffi - DIETI
1 st	APEF Webinar	0.4	Edoardo Consiglio, Luigi Fusco Girard, Massimo Marrelli, Luigi Nicolais, Massimo Villone	University of Naples Federico II	Associazione Professor i Emeriti Federiciani
1 st	Joint Design of Optics and Post-Processing Algorithms Based on Deep Learning for Generating Advanced Imaging Features	0.4	Raja Giryes	Tel Aviv University, Tel Aviv, Israel	IEEE Computational Imaging Technical Committee
1 st	Virtual Seminars on "Sensing"	0.8	J. Wenger, C. Rockstuhl, L. Baldassarre, M. Fleischer	Istitute Fresnel, France Karlsruher Institut fur Technologie, Germany University of Roma Sapienza Universitat Tubigen, Germany	Plasmonica Prof. Carlo Forestier e, DIETI
1 st	Adversarial Attacks On Image Classifiers	0.4	Andrea Cavallaro	Queen Mary University of London	CVPL CV & ML
1 st	AI Webinars Series on Deep Learning for CINI AIIA Labs	0.3	Dr. Christian Hundt	NVIDIA	NVIDIA AI Technology
1 st	Free Virtual Seminar: Deep Learning in Wireless Communications	0.2	Prof. Geoffrey Ye Li	School of Electrical and Computer Engineering at Georgia Institute of Technology	Yue Gao - Chair of IEEE ComSoc TCCN
1 st	Algorithmic Accountability – Affidabilità e responsabilità degli algoritmi	0.4	Prof. Joshua Kroll, Prof. Fabio Bassan, Prof. Giovanna De Minico, Prof. Giuseppe Francesco Italiano	Naval Postgraduate School, California University of Rome Tre University of Naples Federico II University Luiss "Guido Carli" European Artificial	Fondazione Ugo Borboni

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			Stefano Quintarelli	Intelligence High Level Group	
1 st	Radar Conference Virtual Summer School (10 hours of lectures)	2	Shannon Blunt, Alfonso Farina, Hugh Griffiths, Sabrina Maria Greco, Marco Martorella, Fabiola Colone, Mike Picciolo, Alexander Charlsh, John Stralka, Frank Robey	University of Kansas Lawrence Department of Electronic and Electrical Engineering, University College London, London, U.K., and with the Centre of Electronic Warfare, Information and Cyber, Cranfield University, Cranfield, U.K. University College London University of Pisa University of Pisa University of Rome Sapienza ENSCO Fraunhofer Institute for Communication, Information Processing and Ergonomics FKIE Systems Engineering, Integration, and Test group of the Engineering & Sciences organization of Northrop Grumman Mission Systems, Baltimore, MD, USA Massachusetts Institute of Technolog	IEEE AESS Radar Summer School
2 nd	Patent Searching Best Practices with IEEE Xplore	0.2	Dr. Eszter Lukacs	IEEE	IEEE
2 nd	How to Get Published with the IEEE	0.2	Dr. Paul Henriques	IEEE	Rachel Berrington
2 nd	Subclonal reconstruction of tumor architectures by using	0.3	Giulio Caravagna	University of Trieste	Prof. Michele Ceccarelli

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	machine learning and population genetics				
2 nd	1st International Virtual School on Radar Signal Processing (10 hours of lectures)	2	L. J. Kong	University of Electronic Science and Technology of China (UESTC)	University of Electronic Science and Technology of China (UESTC)
2 nd	Advances in Machine Learning for Modelling and Understanding in Earth Sciences – Gustau Camps-Valls	0.2	Prof. Gustau Camps-Valls	University of Valencia	IEEE Geoscience and Remote Sensing South Italy Chapter
2 nd	Robo Ludens: A game design taxonomy for human-robot interaction, Dr. John Edison Muñoz Cardona	0.2	Dr. John Edison Muñoz Cardona	University of Waterloo, Canada	Prof.ssa S. Rossi, PRISCA Lab. - DIETI
2 nd	Dai mainframe all’IoT: una retrospettiva sull’evoluzione delle architetture di calcolo - prof. Antonino Mazzeo	0.4	Prof. Antonino Mazzeo	University of Naples Federico II	Prof. Alessando Cilardo (DIETI, UniNA)
2 nd	Electrical and Computer Engineering (ECE) Seminar: Towards Neural Signal Processing and Imaging	0.2	Dr. Gordon Wetzstein	Stanford University	Prof. Shiva Abbaszadeh
2 nd	Electrical and Computer Engineering (ECE) Seminar: 6G: A New Frontier for the Design of NOMA	0.2	Prof. Zhiguo Ding	University of Manchester	Dr. Shuping Dang
2 nd	Antonio Picariello Lectures on Data Science (Lecture 5-14- 15-16-17): “At the Nexus of Big Data, Machine Intelligence, and Human Cognition”, “Visual Interaction and Communication in Data Science”, “Big Data and Computational Linguistics”, “Sensoria Health”, “The coming revolution of Data driven Discovery”	1.5	Prof. George S. Djorgovski, Marco Quartulli, Prof. Francesco Cutugno, Stefano Rossotti Prof. Giuseppe Longo	California Institute of Technology Data Intelligence group for Energy Industry and the Environment University of Naples Federico II Sensoria Health University of Naples Federico II	Prof. Flora Amato (DIETI, UniNA) Prof. Giuseppe Longo (Fisica “Ettore Pancini” - UniNA)
2 nd	Advanced Topics in Radar Signal Processing	1.6	dr. Alfonso Farina	Department of Electronic and Electrical Engineering, University College London, London,	Profs. Augusto Aubry, Antonio De Maio Dr. Vincenzo Carotenuto DIETI, UniNA

				U.K., and with the Centre of Electronic Warfare, Information and Cyber, Cranfield University, Cranfield, U.K.	
3 rd	Project Vāc: Can a Text-to-Speech Engine Generate Human Sentiments?, Dip. Fisica, "Ettore Pancini"	0.2	Prof. V. K. Gubani	Institute of Technology, Illinois	Dip. Fisica, "Ettore Pancini" - DIETI, UniNA
3 rd	Using Delays For Control-	0.2	Prof. Emilia Fridman	Tel Aviv University, Tel Aviv, Israel	Prof. Stefania Santini - DIETI - UniNA
3 rd	Vine robots: design challenges and unique opportunities	0.2	Dr. Nicholas Naclerio	University of California Santa Barbara, Santa Barbara, USA	Dr. Mario Selvaggio, DIETI - UniNA

Research activities

Angela Marino's research has been focused on the design of advanced algorithms for the detection and localization of targets.

First, the problem of adaptive target detection for Frequency Diverse Array Multiple-Input Multiple-Output (FDA-MIMO) radars has been addressed. This problem has been formalized as a composite binary hypothesis test, where the interference covariance matrix, as well as the range and echo-amplitude of the target have been assumed unknown. Then, leveraging generalized likelihood ratio paradigm, an optimization procedure has been designed to determine the Maximum Likelihood (ML) estimate of the unknown parameters under both the hypothesis, which lay the ground for the computation of the theoretical one-step and two-step receivers. Furthermore, to reduce the computational burden, approximated solution methods have been designed. At the analysis stage, performance comparison among the proposed adaptive detectors, the benchmarks (clairvoyant) as well as some mismatched architectures has been carried on, showing that the proposed adaptive strategies detect targets with performance quite close to that of the clairvoyant structures.

Then, the problem of 2D target localization through the joint use of an active radar and a Passive Bistatic Radar (PBR), has been considered. Leveraging the Least Square (LS) estimation methodology, the elliptic localization has been formulated as a constrained optimization problem aimed at minimizing the model equation discrepancy from the measured parameters while accounting for specific constraints on the feasible target positions. These constraints are induced both by the PBR main-beam size and by the available side-information, provided by the active radar. To tackle the resulting non-convex optimization problem, the Karush-Kuhn-Tucker (KKT) optimality conditions have been exploited. Hence, an efficient optimization strategy has been designed to solve the formulated localization problem, providing a closed-form optimal location estimate. The analyses have revealed that the proposed technique outperforms the counterparts in terms of Root Mean Square Error (RMSE) for both a static and dynamic scenario.

The third research activity has been focused on 3D localization problem in multiplatform systems with a single transmitter and multiple receivers (one of them co-located with the transmitter). Angular constraints have been forced on the target position to capitalize on the information embedded into the characteristics of the active node radiation pattern, formulating the localization as a constrained LS problem. The resulting non-convex optimization problem has been efficiently handled invoking the KKT optimality conditions and a novel 3D target localization has been derived. The performance of the proposed algorithm has been analysed in terms of RMSE, proving that the devised technique achieves a significant accuracy gain over the counterparts, especially for weak target returns.

Finally, studies have been conducted with reference to the development of an advanced Multitarget Tracking (MTT) technique for multiplatform systems comprising one transmitter and multiple receivers (one of them co-located with the transmitter). In this regard, a solution to combine single-snapshot localization algorithms and Sum-Product Algorithm (SPA)-based MTT has been investigated in order to boost the accuracy of the overall surveillance system. In particular, SPA-based MTT technique is enhanced by a particles generation process which exploits the one-shot position estimate provided by a bespoke target location estimate. The results of the performed simulations have shown the benefits of the proposed strategy in comparison with the conventional SPA-based MTT.

Tutoring and supplementary teaching activities *(list only authorized activities)*

Seminars, BSc and MSc thesis tutorship, laboratory set up activities, ...

Credits summary *(Sum up all earned credits)*

PhD Year	Courses	Seminars	Research	Tutoring / Supplementary Teaching
1 st	27.5	8.4	34	
2 nd	20	7	42	
3 rd	0	0.6	50	

Motivare eventuali difformità significative nel percorso di formazione rispetto a quanto l'organizzazione del dottorato prevede come standard e che è riassunto dalla tabella seguente – Cancellare se non ci sono difformità significative.

Iter formativo	corsi / scuole	seminari	attività ricerca	tutorato / did. int.
1 anno	min 20 - max 40	min 5 - max 10	min 10 - max 35	min 0 – max 1.6
2 anno	min 10 - max 20	min 5 - max 10	min 30 - max 45	min 0 – max 1.6
3 anno	min 0 - max 10	min 0 - max 10	min 40 - max 60	min 0 – max 1.6
TOTALE	min 30 – max 70	min 10 – max 30	min 80 – max 140	min 0 – max 4.8

Research periods in institutions abroad and/or in companies

PhD Year	Institution / Company	Hosting tutor	Period	Activities
1 st				
1 st				
2 nd	Centre for Maritime Research & Experimentation NATO, La Spezia	Paolo Braca, PhD		Study on filtering/tracking algorithms and target motion models. Development and test of localization algorithms for multiplatform radar systems. Research activity on Multitarget Tracking (MTT) technique for multiplatform systems.
3				

PhD Thesis

In her PhD thesis, Angela Marino deals with the development of innovative localization algorithms for some sensing systems of practical relevance. Specifically, three novel techniques have been devised.

The first strategy, referred to as Angular and Active Constrained Least Square (AACLS), is an algorithm for 2D PBR localization via the joint exploitation of multiple illuminators of opportunity and measurements gathered by a co-located active radar, i.e., information acquired by a basic version of a MPRN. This technique exploits angular and range constraints resulting from prior knowledge of the PBR beam extent and uncertainty of active radar data.

The second algorithm, denoted as Angular and Range Constrained Estimator (ARCE), is a 3D localization technique for MPRNs, comprising one transmitter and multiple receivers (one of them collocated with the transmitter). In particular, ARCE leverages ad-hoc constraints in order to capitalize on the information embedded into the monostatic sensor radiation pattern features. The third algorithm is obtained combining ARCE and the SPA-based MTT technique. Specifically, the latter is enhanced through a bespoke particles generation process exploiting the ARCE position estimate.

Publications

Research results appear in 3 papers published in international journals, 5 contributions to international conferences.

List of scientific publications (list papers in the following format – remove categories with no publications)

International journal papers

A. Aubry, P. Braca, A. De Maio and A. Marino,
Enhanced Target Localization With Deployable Multiplatform Radar Nodes Based on Non-Convex Constrained Least Squares Optimization,
IEEE Transactions on Signal Processing,
vol. 70, pp. 1282-1294, 2022, DOI: 10.1109/TSP.2022.3147037.

A. Aubry, P. Braca, A. De Maio and A. Marino,
2-D PBR Localization Complying With Constraints Forced by Active Radar Measurements,
IEEE Transactions on Aerospace and Electronic Systems,
vol. 57, pp. 2647-2660, 2021, DOI: 10.1109/TAES.2021.3067612.

L. Lan, A. Marino, A. Aubry, A. De Maio, G. Liao, J. Xu, and Y. Zhang,
GLRT-Based Adaptive Target Detection in FDA-MIMO Radar,
IEEE Transactions on Aerospace and Electronic Systems,
vol. 57, pp. 597-613, 2021, DOI: 10.1109/TAES.2020.3028485.

International conference papers

A. Marino, A. Aubry, A. De Maio, P. Braca,
2D Constrained PBR Localization Exploiting Active Radar Measurements,
SET-284 Specialists' Meeting on Enhanced Situation Awareness using Active-Passive Radar Systems in Military Scenarios,
Gdynia, Poland, 15-16 September 2022.

A. Marino, A. Aubry, A. De Maio, P. Braca, D. Gaglione and P. Willett,
Constrained Target Localization for Multiplatform Radar Systems,
MILCOM 2021-2021 IEEE Military Communications Conference (MILCOM),
San Diego, CA, USA, 29 Nov.-2 Dec. 2021, pp. 635-640, IEEE, DOI:
10.1109/MILCOM52596.2021.9653089.

A. Marino, A. Aubry, A. De Maio and P. Braca,
3D Localization for Multiplatform Radar Networks with Deployable Nodes,
2021 Signal Processing Symposium (SPSymposium),
Lodz, Poland, 20-23 Sept. 2021, pp. 183-188, IEEE, DOI: 10.1109/SPSymposium51155.2020.959353.

A. Marino, A. Aubry, A. De Maio and P. Braca,
2D Constrained PBR Localization Via Active Radar Designation,
2020 IEEE Radar Conference (RadarConf20),
Florence, Italy, 21-25 Sept. 2020, pp. 1-6, IEEE, DOI: 10.1109/RadarConf2043947.2020.9266695.

L. Lan, A. Marino, A. Aubry, A. De Maio, G. Liao and J. Xu,
Design of GLR-Based Detectors for FDA-MIMO radar,
2020 IEEE 7th International Workshop on Metrology for AeroSpace (MetroAeroSpace),
Pisa, Italy, 22-24 June 2020, pp. 17-21, IEEE, DOI: 10.1109/MetroAeroSpace48742.2020.9160020.

L. Lan, A. Marino, A. Aubry, A. De Maio, G. Liao and J. Xu,
Design of adaptive detectors for FDA-MIMO radar,
2020 IEEE 11th Sensor Array and Multichannel Signal Processing Workshop (SAM),
Hangzhou, China, 8-11 June 2020, pp. 1-5, IEEE, DOI: 10.1109/SAM48682.2020.9104289.

Patents and/or spin offs

List them including title, countries, brief description (50-100 words)

Awards and Prizes

Angela Marino ranked third to the Student Contest of the 1st International Virtual School on Radar Signal Processing held from the University of Electronic Science and Technology of China (UESTC), 22-23 December 2020, with the contribution:

A. Marino, A. Aubry, A. De Maio and P. Braca, "2D Constrained PBR Localization Via Active Radar Designation," 1st International Virtual School on Radar Signal Processing University of Electronic Science and Technology of China (UESTC), 22-23 December 2020.

Angela Marino was the recipient of the first prize at the Young Scientist Contest Award of the Signal Processing Symposium (SPSympo) 2021, 21-23 September 2021, Lodz, Poland, with the contribution:

A. Marino, A. Aubry, A. De Maio and P. Braca, "3D Localization for Multiplatform Radar Networks with Deployable Nodes," 2021 Signal Processing Symposium (SPSympo), 2021.

Date 20/10/2022

PhD student signature



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Supervisor signature

Augusto Aubry
