UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

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

Activities and Publications Report

PhD Student: Salvatore Marcellini

Student DR number: DR995142

PhD Cycle: XXXVI
PhD Cycle Chairman: Prof. Stefano Russo

PhD program student's start date: 01/10/2020
PhD program student's end date: 31/09/2023

Supervisor: Prof. Vincenzo Lippiello

e-mail: vincenzo.lippiello@unina.it

Co-supervisor: Prof. Fabio Ruggiero

e-mail: fabio.ruggiero@unina.it

PhD scholarship funding entity: LEONARDO S.p.A.

General information

Name Surname received in year 2020 the Master Science degree in Automation Engineering from the University of Napoli Federico II. He attended a curriculum in name_of_subject within the PhD program in Information Technology and Electrical Engineering. He received a grant Leonardo S.p.A.

Study activities

Attended Courses

Year	Course Title	Type	Credits	Lecturer	Organization
1st	Short course on Deep Learning and Computer Vision for Autonomous Systems – Focus on drone vision, imaging, surveillance and cinematography	Ad hoc course	1.5	Prof. Ioannis Pitas	Aristotle University of Thessaloniki
1st	Modeling Complex Systems	Ad hoc course	6.0	Prof. Mario Di Bernardo	Scuola Superiore Meridionale
1st	Scientific Programming and Visualization with Python	Ad hoc course	3.0	Prof. Alessio Botta	Università di Napoli Federico II
1st	Statistical data analysis for science and engineering research	Ad hoc course	4.0	Prof. Roberto Pietrantuono	Università di Napoli Federico II
	Robotics Lab	MsC Course	6.0	Prof. Vincenzo Lippiello, Prof. Jonathan Cacace	Università di Napoli Federico II
	Strategic Orientation for STEM Research & Writing	Ad hoc course	5.0	Ms. Chie Shin Fraser	Università di Napoli Federico II
2nd	Neural Networks and Deep Learning	Ad hoc course	6.0	Prof. Giorgio Buttazzo	TeCIP, Scuola Superiore Sant'Anna
	Imprenditorialità accademica	Ad hoc course	4.0	Prof. Pierluigi Rippa	Università di Napoli Federico II
3rd	Title	Ad hoc course	…		University of ………., State

Attended PhD Schools

Year	School title	Location	Credits	Dates	Organization
2st	IEEE RAS Summer school on multirobot system	Prague, Czech Republic	2	01.08.2022 – 07.08.2022	Czech technical university in Prague, Czech Republic

Attended Seminars

Year	Seminar Title	Credits	Lecturer	Lecturer affiliation	Organization
1st	Patent Searching Best Practices with IEEE Xplore	0.2	Paul Henriques	External seminar	IEEE
1st	How to Get Published with the IEEE	0.2	Paul Henriques	External seminar	IEEE
1st	Network Systems, Kuramoto Oscillators, and Synchronous Power Flow	0.3	Prof. Francesco Bullo	External seminar	Scuola Superiore Meridionale
1st	Robot Manipulation and Control	0.5	Prof. Bruno Siciliano	External seminar	Scuola Sant'Anna Pisa
1st	Advances in Machine Learning for Modeling and Understanding in Earth Sciences	0.3	Prof. Gustau Camps-Valls	External seminar	IEEE Geoscience and Remote Sensing South Italy Chapter, chaired by Prof. Antonio Iodice
1st	Quadruped Robotics on the Rise	0.4	Avik De, Sangbae Kim, Claudio Semini, Benjamin Swilling	External seminar	IFRR, moderated by Prof. Marco Hutter
1st	The coming revolution of Data driven Discovery	0.3	Prof. Giuseppe Longo	External seminar	Scuola Superiore Meridionale
1st	Artificial Intelligence and 5G combined with holographic technology: a new perspective for remote health monitoring	0.4	Dr. Pietro Ferraro, Dr. Pasquale Memmolo	Università di Napoli Federico II	5G Academy's, Prof. Antonia Maria Tulino
1st	Modelling the Complexity of Multiagent Activity for Human-AI Interaction using Dynamical Primitives	0.3	Prof. Michael Richardson	Università di Napoli Federico II	Scuola Superiore Meridionale
1st	Introduction to Underwater robotics	0.4	Prof. Gianluca Antonelli	Università di Napoli Federico II	Università di Napoli Federico II

1st	SAR Polarimetry: Theory, Machine Learning & Applications	0.4	Carlos López-Martínez	Università di Napoli Federico II	Università di Napoli Federico II with IEEE
1st	Localized least-squares radial basis function methods for PDEs	0.2	Elisabeth Larsson, Uppsala Universitet, Sweden	Università di Napoli Federico II	Università di Napoli Federico II
1st	Picariello Lectures on Data Science	0.4	Prof. Flora Amato, Prof. Giuseppe Longo	Università di Napoli Federico II	Università di Napoli Federico II
1st	La norma ISO 27001 e la sua contestualizzazione nel panorama normativo nazionale ed internazionale	0.4		Università di Napoli Federico II	Università di Napoli Federico II
2nd	Coverage control for robotic swarms: Heterogeneity, Learning, and Artistic Expression	0.3	Maria Santos	External seminar	RAS Bolivia Chapter
2nd	Adaptive and learning controllers for high accuracy trajectory tracking in changing environments	0.3	Karime Pereida	External seminar	RAS Bolivia Chapter
2nd	Cyber security in Akka Technologies	0.3	Luigi Villa, Luigi Guida	External seminar	AKKA Technologies
2nd	Design, Learning, and Control for Safe Human-Robot Collaboration	1.2	Several lecturers	External seminar	Workshop of 20th International Conference on Advanced Robotics
2nd	Swetaly workshop on the theme of AI	0.8	Several lecturers	External seminar	Örebro University, Gothenburg University
2nd	Evento Osservatori Digital Innovation: Workshop di Kick-off Osservatorio Droni	0.5	Prof. Marco Lovera	External seminar	Politecnico di Milano
2nd	IEEE Authorship and Open Access Symposium: Tips and Best Practices to Get Published from IEEE	0.2	Dr. Derek Abbott, Dr. Paolo Bonato	External seminar	IEEE Authorship and Open Access
2nd	On using simple optimization techniques for tuning UaVs	0.4	Dariusz Horla	University of Naples Federico II	Prof. Fabio Ruggiero
2nd	Workshop: Shared Autonomy in Physical Human-Robot	1.6	Several lecturers	ICRA 2022	Ph.D. Mario Selvaggio

	Interaction: Adaptability and Trust					
2nd	Vine robots: design challenges and unique opportunities	0.2	Eng. Nicholas Naclerio	External seminar	Ph.D. Mario Selvaggio	
2nd	PX4 Developer Summit	3.2	Several lecturers	External seminar	Dronecode Foundation	
3rd	QP-based full body control	0.4	Adrien Escande	INRIA, Rennes (France)	Paolo Robuffo Giordano,	
3rd	Numerical Optimization and Motion Generation for Robotics	0.4	Adrien Escande	INRIA, Rennes (France)	Paolo Robuffo Giordano,	
3rd	Energy Based Control for a robustly stable and flexible interaction	0.3	Christian Secchi	INRIA, Rennes (France)	Paolo Robuffo Giordano,	

Research activities

During the three-year course, Dr. Salvatore Marcellini deepened his knowledge of motion planning techniques for autonomous robots. In particular, he applied techniques present in the state of the art to an autonomous drone for navigation in indoor environments and participate in the "Leonardo drone contest." During his research period at the INRIA research center, in Rennes (FR), he studied, developed and implemented new optimization algorithms for robust trajectory planning with parametric uncertainties. Finally, thanks to the collaboration with the startup Neabotics, he was able to test and implement control algorithms for omnidirectional tilting drones present in the state of the art, on innovative platforms developed in-house at the PRISMA laboratory. This activity led to the development of a new open source firmware for the control of drones with tilting rotors

Tutoring and supplementary teaching activities

Dr. Salvatore Marcellini provided tutoring and supplementary teaching for the Robotics Lab course of the Master of Science in Automation Engineering degree program. Dr. Marcellini has conducted seminars concerning the control, programming and construction of drones

Credits summary

PhD Year	Courses	Seminars	Research	Tutoring / Supplementary Teaching
1st	25.5	4.4	31.9	0
2nd	12.0	9.4	38.8	1.6
3rd	0	1.1	59.9	0
Total	37.5	14.9	130.6	1.6

In the 1st year, due to an overlap between the dates of the seminars and the end of the doctoral academic year, 2 seminars were registered in the second year instead of the first year, leading to the lack of 0.6 credits for the first year. Nevertheless, the number of total credits in the 3 years related to seminars exceeds the minimum number required

Research periods in institutions abroad and/or in companies

PhD Year	Institution / Company	Hosting tutor	Period	Activities
1st	University of …, City, Country	Name Surname, role		Research on … Lab experiments on … Joint scientific paper preparation …
1st	Company name	Name Surname, role		On-field experiments on …
2nd				
3				

PhD Thesis

In his thesis, Eng. Salvatore Marcellini addresses the development of motion planning techniques for autonomous unmanned aerial vehicles. The focus is first on trajectory design based on closed-loop sensitivity theory, which shifts the emphasis from the design of traditional controls to the generation of control-aware trajectories for a more versatile approach. These trajectories are tested with both a commercial drone and a new omnidirectional multirotor with tilting rotors. Next, optimal trajectory planning for repetitive reconnaissance of regions of interest using autonomous robots is explored. In this context, a new approach based on nonlinear predictive control is introduced. This method provides an online solution that evolves over time, allowing the overseer to adapt its behavior in response to changes in the environment and the value of interest of different regions. It also facilitates collaboration with other potential scouts.

Research products

Research results appear in 0 papers published in international journals, *0* papers published in national journals, 2 contributions to international conferences, *0* contributions to national conferences, *0* patents.

List of scientific publications

International conference papers

S. Marcellini, F. Ruggiero and V. Lippiello

"Nonlinear Model Predictive Control for Repetitive Area Reconnaissance with a Multirotor Drone",

2023 International Conference on Unmanned Aircraft Systems (ICUAS),

Warsaw,Poland, 2023, pp. 1089-1096, doi: 10.1109/ICUAS57906.2023.10156642.

International conference papers

S. Marcellini, J. Cacace and V. Lippiello

" A PX4 Integrated Framework for Modeling and Controlling Multicopters with Til table Rotors",

2023 International Conference on Unmanned Aircraft Systems (ICUAS),

Warsaw,Poland, 2023, pp. 1089-1096, doi: 10.1109/ICUAS57906.2023.10156642

International conference papers – Accepted not yet published

S. Marcellini, S. D'Angelo, M. Marolla, A. De Crescenzo, V. Lippiello and B. Siciliano

Development of a semi-autonomous framework for NDT inspection with a tilting aerial platform",

18th International Symposium on Experimental Robotics (ISER 2023),

Chiang Mai, Thailand, 2023,

International conference papers – Under Review

A. Srour, S. Marcellini, T. Belvedere, M. Cognetti, A. Franchi and P.Robuffo Giordano

" Experimental Validation of Sensitivity-Aware Trajectory Planning for a Quadrotor UAV Under Parametric Uncertainty",

2024 IEEE International Conference on Robotics and Automation (ICRA2024),

Yokohama, Japan,

Patents and/or spin offs

Awards and Prizes

Date ____20/10/2023_____

PhD student signature _Salvatore Marcellini_

Supervisor signature _Vincenzo Lippiello_