

DIAG - Research areas

Biomedical Engineering

Economics

Engineering in Computer Science

Management Engineering

Operations Research

Systems and Control Engineering

Research Report 2018

Dipartimento di Ingegneria Informatica, Automatica e Gestionale Antonio Ruberti



DIPARTIMENTO DI INGEGNERIA INFORMATICA,
AUTOMATICA E GESTIONALE ANTONIO RUBERTI

Research Report 2018



SAPIENZA
UNIVERSITÀ DI ROMA

Dipartimento di Ingegneria Informatica, Automatica e Gestionale Antonio Ruberti

Via Ariosto 25, 00185 Roma

www.diag.uniroma1.it

Dipartimento di Ingegneria informatica, automatica e gestionale
Antonio Ruberti
Sapienza Università di Roma

Research Report 2018

Dipartimento di Ingegneria informatica, automatica e gestionale Antonio Ruberti

Sapienza Università di Roma

Via Ariosto 25

00185 Roma

Italia

T +39 06 77274140

F +39 06 77274129

<http://www.diag.uniroma1.it>

Cura e composizione: Alessandro DI GIORGIO e Daniela IACOVIELLO
Tiziana CATARCI

I edizione: Luglio 2019

Contents

1	Introduction	1
2	General Information	2
2.1	Location	2
2.2	Facilities	2
2.3	People	6
2.4	Doctoral Programs	8
2.5	Visiting Scientists and Scholars	13
2.6	Seminars and Workshops	13
2.7	Honours and Awards	16
2.8	Contracts	17
3	Research Areas	21
3.1	Biomedical Engineering	22
3.1.1	Bioengineering and Bioinformatics	22
3.2	Economics	25
3.2.1	Innovation, Internationalization and the Environment	25
3.3	Engineering in Computer Science	27
3.3.1	Algorithm Design and Engineering	27
3.3.2	Algorithms and Data Science	30
3.3.3	Artificial Intelligence and Knowledge Representation	31
3.3.4	Artificial Intelligence and Robotics	35
3.3.5	Computer Networks and Pervasive Systems	38
3.3.6	Computer Vision, Computer Graphics, and Perception	40
3.3.7	Cybersecurity	44
3.3.8	Data Management and Service-Oriented Computing	48
3.3.9	Distributed Systems	52
3.3.10	High Performance and Dependable Computing Systems	54
3.3.11	Human-Computer Interaction	56
3.4	Management Engineering	59
3.4.1	Industrial Organization and Management	59
3.5	Operations Research	62
3.5.1	Combinatorial Optimization	62
3.5.2	Continuous Optimization	64
3.6	Systems and Control Engineering	67
3.6.1	Networked Systems	67
3.6.2	Nonlinear Systems and Control	69
3.6.3	Robotics	72
4	Publications	74

1 Introduction

The present document is a report about the research activity carried out in 2018 at the Department of Computer, Control and Management Engineering Antonio Ruberti (DIAG) of the Sapienza University of Rome.

DIAG (formerly known as DIS - *Dipartimento di Informatica e Sistemistica "Antonio Ruberti"*) was established in 1983 as an evolution of the *Istituto di Automatica*; in 2001 it was named after Antonio Ruberti, the eminent scholar who founded it. For many years DIAG was distributed over three sites far apart from each other. In May 2007 it moved to the completely renewed premises of Via Ariosto 25, in the center of Rome. In 2011 the department changed its Italian name to the new *Dipartimento di Ingegneria informatica, automatica e gestionale "Antonio Ruberti"* with the aim of better representing its current expertise and interests.

DIAG is a center for research and education at the undergraduate and graduate levels in computer, system, and management sciences. Basic research is the main goal of DIAG, with a strong emphasis on interdisciplinary research, on applications that stimulate basic research, and with a specific attention to technology transfer and dissemination of results. Collaborations are maintained with researchers in other university departments, research institutions and companies, in Italy and abroad.

At the beginning of 2018, DIAG has been selected by the Ministry of Education, University and Research as one of the 180 departments of excellence in Italy, and has been assigned 8.5 million euros of funding. The purpose of the financing is the creation of an international pole of excellence in cybersecurity - strengthening and enhancing the DIAG outstanding expertise in its various research areas - with investments in human resources, infrastructures and highly qualified teaching activities.

The main educational goal is to prepare students for professional, research and teaching careers either in universities or in industries in information technologies, automation, and management. The faculty of DIAG in 2018 consists of 24 full professors, 23 associate professors, and 21 assistant professors (ricercatori). They offer educational services at undergraduate and graduate level to several programs of the two schools of Engineering at Sapienza (*Facoltà di Ingegneria dell'Informazione, Informatica e Statistica* and *Facoltà di Ingegneria civile ed industriale*), and at graduate level to the Master in *Product Design*, of the school of Architecture (*Facoltà di Architettura*), with main responsibility in the curricula in informatics, systems and control, and engineering management. Details about teaching activities are not reported in this document; a description may be found at <http://www.diag.uniroma1.it>, under section "Teaching". DIAG offers also two PhD programs, and cooperates with a PhD program offered by another department. They are briefly described in Section 2.4 of this report.

DIAG's research activity is organized in 6 research areas, each composed of one or more research groups. An overview of the groups is reported in Section 3, together with the list of people involved in 2018. A collection of the Department's publications for 2018 is reported in Section 4.

2 General Information

2.1 Location

The location of DIAG is the building formerly known as “Scuola Silvio Pellico”, in Via Ariosto 25, Rome. DIAG is on the web at <http://www.diag.uniroma1.it>.

2.2 Facilities

Library

Founded in 1969, the Library of the Department collects books and periodicals related to computer science, control theory, robotics and management engineering. It owns over 12,000 volumes and 450 periodicals. The Library complements its collection with user access to all the key online resources, bibliographic databases, eBooks (accessible both on the library website and in the central online catalog), and scientific content discovery services. In particular, the Library provides access to the main databases in IT and management, i.e., IEEE Library, ACM Library and Derwent Innovation. The Library is open from Monday to Friday 8.30 - 19.30, Saturday 9:00 -13:00. There are two reading rooms available for students, for a total of 87 places. The Library facilities are also available to students and faculty of other departments and universities. In addition to the normal librarian activity, the Library organized presentations of the department’s degree courses (OpenDIAG), conferences on specific topics, and book presentations. The Library has also organized a project for the Alternanza Scuola Lavoro for 20 secondary school students. Finally, the Library staff helps professors to insert the research products in the IRIS database.

Research Laboratories

Several research laboratories pertain to DIAG. The following list reports name, location, purpose, and the person in charge for each of them.

ALCOR - Vision, Perception and Learning Robotics Laboratory

Via Ariosto 25 - room S011/S012, basement

The laboratory is devoted to the development of autonomous systems for operating in unstructured and rescue environments, as well as vision based systems for navigation, environment reconstruction and recognition.

Web: <http://www.diag.uniroma1.it/~alcor>

Head: Fiora PIRRI

BiBiLab - Bioengineering and Bioinformatics Laboratory

Via Ariosto 25 - room S005, basement

The laboratory aims to develop interdisciplinary methodologies by integrating diverse fields, such as signal processing, computer science, systems science, and statistics applied to medical and biological sciences, specifically including: modeling of metabolic

systems, information processing from raw molecular biological data to solve interesting biological and medical problems, non-invasive estimation of the electrical activity and functional connectivity of the human brain, development of brain-computer interfaces for assistive and rehabilitation purposes.

Web: <http://bibilab.diag.uniroma1.it>

Co-Heads: Laura ASTOLFI and Febo CINCOTTI

Data And Service Integration Laboratory (DASILab)

Via Ariosto 25 - room B213, wing B2

The laboratory is devoted to the development of software research prototypes for service-based and data-integration systems.

Web: <http://www.diag.uniroma1.it/dasilab>

Head: Maurizio LENZERINI

Organization: Massimo MECELLA

E-learning systems and applications laboratory (ELSA)

Via Andrea Doria 5 (Latina)

In the laboratory, advanced e-learning strategies for robotics and control systems are addressed, developed, implemented and tested through the use of real devices (mobile and articulated robots) available by a web based connection.

Web: <http://infocli31.dislt.uniroma1.it/elsa>

Co-Heads: Paolo DI GIAMBERARDINO and Marco TEMPERINI

Research Center of Cyber Intelligence and Information Security (CIS)

Via Ariosto 25 - room B113, wing B1

It is a multidisciplinary center developing new knowledge and operational methodologies to gather relevant information from cyber and physical environments and to transform it through intelligence processes in enriched information that can be used to prevent incidents that can harm the society by creating at the same time smarter complex systems.

Web: <http://www.cis.uniroma1.it/>

Head: Alberto MARCHETTI SPACCAMELA

Network Control Laboratory

Via Ariosto 25 - room A215, wing A2

The laboratory is devoted to the design, simulation, and experimental validation of advanced resource management, service management and interoperability management procedures for wireless and wired telecommunication networks as well as in energy distribution networks.

Web: <http://labreti.ing.uniroma1.it/>

Head: Francesco DELLI PRISCOLI

DIAG Robotics Lab

Via Ariosto 25 - room S007/S009, basement

The laboratory focuses on the development of advanced planning and control techniques

for both industrial and service robots. Experimental validation takes place on fixed-base manipulators, mobile robots, humanoids and flying robots.

Web: <http://www.diag.uniroma1.it/~labrob>

Head: Giuseppe ORIOLO

ROCOCO - COgnitive COoperating RObots Laboratory

Via Ariosto 25 - room S010, basement

The laboratory deals with the experimental activities aiming at the implementation of intelligent robots, in several application domains, including agricultural robotics, robots for cultural heritage and service robots. The laboratory is responsible of the SPQR team, which participates in several international robotics competitions.

Web: <http://www.diag.uniroma1.it/~labrococo/>

Head: Daniele NARDI

Systems and Control Laboratory

Via Ariosto 25 - room S008, basement

The laboratory is devoted to the development and experimental verification of new control strategies.

Web: <http://www.diag.uniroma1.it/~syscon/>

Head: Paolo DI GIAMBERARDINO

Web Algorithmics and Data Mining Laboratory (WADAM)

Via Ariosto 25 - room A220, wing A2

The laboratory is devoted to the design of algorithms for web and data-mining related problems.

Web: <http://wadam.diag.uniroma1.it>

Head: Aris ANAGNOSTOPOULOS

Wireless Sensor Networks Laboratory

Via Ariosto 25 - room S006, basement

The laboratory is devoted to the development and experimental verification of protocols and algorithms for WSNs.

Web: <http://www.diag.uniroma1.it/~ficarola/wsn-group/>

Head: Andrea VITALETTI

Additional information on the research laboratories may be found at

<http://www.diag.uniroma1.it/en/node/60/research-laboratories>.

Educational Laboratories

DIAG manages also two educational laboratories of the School of Engineering, located outside the DIAG building and used for hands-on teaching and for studying. These are named after Paolo Ercoli, the founder of the Computer science component of the

department.

Computer Science Laboratory Paolo Ercoli for introductory courses
Via Tiburtina 205, Roma.

About 150 stations are available for undergraduate teaching.
Person in charge: Umberto NANNI.

PC and Workstations Laboratory Paolo Ercoli for advanced courses
Via Eudossiana 18, Roma.

About 75 PC and workstations are available for the graduate teaching.
Person in charge: Umberto NANNI.

Management Engineering Laboratory

Via Ariosto 25 - room A122 and A123, wing A1

11 PCs are available. The laboratory is devoted to thesis students for the development of mathematical models and solution algorithms for Management Engineering problems.

Web: <http://www.diag.uniroma1.it/~labinggest>

Person in charge: Massimo ROMA

Additional information on educational laboratories may be found at <http://www.diag.uniroma1.it/en/node/59/teaching-laboratories>.

2.3 People

Head of Department Alberto MARCHETTI SPACCAMELA (up to October 2018)
Tiziana CATARCI (since November 2018)

Administration Head Venerino FILOSA

Professors

Giorgio AUSIELLO (emeritus)
Roberto BALDONI
Stefano BATTILOTTI
Luigia CARLUCCI AIELLO (emeritus)
Giuseppe CATALANO
Tiziana CATARCI
Bruno CICIANI
Giuseppe DE GIACOMO
Alessandro DE LUCA
Francesco DELLI PRISCOLI
Camil DEMETRESCU
Gianni DI PILLO (emeritus)
Francisco FACCHINEI
Alberto ISIDORI (emeritus)
Maurizio LENZERINI
Stefano LEONARDI
Claudio LEPORELLI
Stefano LUCIDI
Alberto MARCHETTI SPACCAMELA
Salvatore MONACO
Umberto NANNI
Daniele NARDI
Alberto NASTASI
Giuseppe ORIOLO
Fiora PIRRI
Riccardo ROSATI
Francesca SANNA RANDACCIO (up to January 2018)
Antonio SASSANO
Marco SCHAERF

Associate professors

Aris ANAGNOSTOPOULOS
Alessandro AVENALI
Luca BECCHETTI
Luca BENVENUTI
Barbara CAPUTO
Ioannis CHATZIGIANNAKIS
Febo CINCOTTI
Fabrizio D'AMORE

Rosa Maria DANGELICO
Cinzia DARAIO
Alberto DE SANTIS
Lorenzo FARINA
Luca IOCCHI
Domenico LAISE (up to October 2018)
Leonardo LANARI
Domenico LEMBO
Paolo LIBERATORE
Massimo MECELLA
Fabio NONINO
Laura PALAGI
Pierfrancesco REVERBERI
Massimo ROMA
Silvio SALZA (up to October 2018)
Giuseppe SANTUCCI
Roberta SESTINI
Marco TEMPERINI

Assistant professors (ricercatori)

Laura ASTOLFI
Roberto BERALDI
Silvia BONOMI
Renato BRUNI
Claudia CALIFANO
Tiziana D'ALFONSO
Marianna DE SANTIS
Paolo DI GIAMBERARDINO
Alessandro DI GIORGIO
Giorgio GRISETTI
Daniela IACOVIELLO
Riccardo LAZZERETTI
Riccardo MARZANO (since March 2018)
Valsamis NTOUSKOS
Fabio PATRIZI
Antonio PIETRABISSA
Alberto PRETTO
Leonardo QUERZONI
Simone SAGRATELLA
Chris SCHWIEGELSHOHN (since October 2018)
Andrea VITALETTI

*Post Doc (research associates)
and research assistants*

Alessandro ANNARELLI
Andrea CALCIOTTI
Massimo CEFALO
Claudio CICCOTELLI
Marco COGNETTI
Chiara CONTI
Emilio COPPA
Daniele Cono D'ELIA
Donato DELL'ATTI
Pierangelo DI SANZO
Simone ECONOMO
Adriano FAZZONE
Luigi FREDA
Claudio GAZ
Francesco LEOTTA
Emanuele MAGRINI
Andrea MARRELLA
Mattia MATTIONI
Lorenzo MAURO
Marta MELONE
Valerio MODUGNO
Giulia PALOMBI
Martina PANFILI
Alessandro PELLEGRINI
Manuela PETTI
Lorenzo RICCIARDI CELSI (up to April 2018)
Francesco RICCIO
Valerio SANTARELLI
Marta SANZARI
Domenico Fabio SAVO

Chris SCHWIEGELSHOHN (up to September
2018)

Mara SORELLA
Piero TOMA
Jlenia TOPPI
Daniele UCCI

Administration staff

Flavia CAGNIZI
Antonella CANCELLIERI
Antonietta CANGELLI
Federica CANNELLI
Ugo CINELLI
Sara CIOTTI
Sabrina GIAMPAOLETTI
Domenico MACARI
Giuseppina MELITA
Maria Pia VANDILLI

Technical staff

Andrea DORI
Luciano GRANDI
Marcello PANI
Tiziana TONI

Auxiliary services

Antonio SIMEONI

Library

Roberta PROIETTI SEMPRONI
Antonietta ZUCCONI

2.4 Doctoral Programs

DIAG hosts the PhD programs in *Automatica, Bioengineering and Operations Research*, in *Data Science* and in *Engineering in Computer Science*.

Automatic Control, Bioengineering and Operations Research

The Academic Board of the PhD program in Automatic Control, Bioengineering and Operations Research is coordinated by Giuseppe ORIOLO.

This PhD program is the result of merging the two former PhD programs in Systems Engineering and in Operations Research, and has now three curricula, i.e., Automatic Control, Bioengineering, and Operations Research. The research topics are: systems theory, nonlinear and optimal control, control applications, robotics, networked systems, metabolic systems, neuroengineering, bioinformatics, bioelectrical signal processing, combinatorial optimization, nonlinear programming, network design, neural networks, logistics.

PhD Students

XXXI course

Khaled AL KHUDIR
Matilde BERTOLI
Stefano BERTULETTI
Emma COLAMARINO
Daniele DE SIMONE
Marco FERRO
Robinson GUACHI
Marianna INGLESE
Federico LISI
Ludovica MACCARRONE
Serena MANTOVANI
Mattia MATTIONI
Anna MELCHIORI
Gianluca MORGANTI
Marco VIOLA

XXXII course

Maria Laura ACETO
Tommaso COLOMBO
Massimiliano D'ANGELO
Eduardo FERREIRA FRANCO
Alessandro GIUSEPPI
Giorgio GRANI
Mohammed HAYMAN SALIH
Maram KHATIB
Maria Grazia PUXEDDU
Nicola SCIANCA

XXXIII course

Yuri ANTONACCI
Barbara BARROS CARLOS
Francesco CURIA
Danny D'AGOSTINO
Paolo FERRARI
Tommaso GIOVANNELLI
Alessio MORESCHINI
Antonio ORNATELLI
Francesco ROMITO
Mirko ROSSI
Ruggiero SECCIA
Andrea TORTORELLI

XXXIV course

Marco BORESTA
Ilaria COCCHI
Anna Livia CROELLA
Mohamed ELOBAID
Roberto GERMANÀ
Andrea ILGRANDE
Alessandro INGROSSO
Esteban SALGADO
Spyridon TARANTOS
Edoardo Maria TRONCI
Giulio TURRISI

PhD theses completed in 2018

Lavinia AMOROSI

Bi-criteria Network Optimization: Problems and Algorithms

Advisor: Paolo DELL'OMO

Alessandra ANZOLIN

Statistical Causality in the EEG for the Study of Cognitive Functions in Healthy and Pathological Brains

Advisor: Laura ASTOLFI

Gabriele BUONDONNO

Numerical Solutions for Design and Dynamic Control of Compliant Robots

Advisor: Alessandro DE LUCA

Andrea CALICIOTTI

Advances in Large Scale Unconstrained Optimization: Novel Preconditioning Strategies for Nonlinear Conjugate Gradient Methods and New Developments in Newton-Krylov Methods

Advisor: Massimo ROMA

Stefano CASCHERA

Analysis and Modeling of the EEG Activity and Connectivity in Post-Stroke Conditions

Advisor: Laura ASTOLFI

Federico CIMORELLI

SDN Workload Balancing and QoE Control in Next Generation Network Infrastructures

Advisor: Francesco DELLI PRISCOLI

Nicolò GIONFRÀ

Stratégies de Commande Distribuée pour l'Optimisation de la Production des Fermes Eoliennes

Advisor: Salvatore MONACO

Marwa HASSAN

Nonlinear and Sampled Data Control with Application to Power Systems

Advisor: Salvatore MONACO

Mattia MATTIONI

Stabilisation of Cascaded Nonlinear Systems Under Sampling and Delays

Doctor Europaeus, double degree with Université Paris-Saclay

Advisor: Salvatore MONACO and Dorothée NORMAND-CYROT

Lorenzo RICCIARDI CELSI

Nonlinear Multi-Agent Control with Application to Networked Systems

Advisor: Salvatore MONACO and Dorothée NORMAND-CYROT

Maryam SALAMI

Two Essays in Computational Optimization: Computing the Clar Number in Fullerene Graphs and Distributing the Errors in Iterative Interior Point Methods

Advisor: Giovanni RINALDI

Data Science

The Academic Board of the PhD program in Data Science is coordinated by Stefano LEONARDI. Data Science is an interdisciplinary field of study that has established itself in recent years in order to offer the methodological tools and technologies necessary for the management and analysis of big data and their valorisation in industry, services, and search. The phenomenon of big data has revolutionized countless sectors of economic-social activity. The phenomenon of big data has also profoundly modified the research methodologies and the development of technological innovation in numerous disciplines and applications. The main objective of this PhD is the realization of interdisciplinary research projects of Data Science that lead to the development of innovative methodologies and technologies based on the use of big data in the following fields of application: i) Advanced digital platforms, ii) Management of urban spaces and environmental resources iii) Medicine and health iv) Economic and Social Analysis.

XXXIV course

Giorgio BARNABÒ

Federico FUSCO

Lorenzo LASTILLA

Leonardo MARTINI

Giovanni TRAPPOLINI

Engineering in Computer Science

The Academic Board of the PhD program in Engineering in Computer Science is coordinated by Camil DEMETRESCU.

The research topics include: theory of algorithms, computer systems, databases, programming languages, theoretical computer science, image processing, artificial intelligence, cognitive robotics, VLSI, computational logics, performance evaluation, distributed software architectures, human-computer interaction, computer networks and security.

PhD Students

XXXI course

Simone ECONOMO
Marco IMPEROLI
Ciro POTENA
Marta SANZARI
Ali YOUSSEF

XXXII course

Dario ALBANI
Gianluca CIMA
Bartolomeo DELLA CORTE
Paola FERRARELLI
Valentina GREGORI
Giuseppe LAURENZA
Massimiliano MANCINI
Marotta ROMOLO
Nizar MASSOUH
Francesco PUJA
Paolo RUSSO
Filipp SAMOILOV
Dominik SCHLEGEL
Mahmoud SHARF
Lun WANG

XXXIII course

Irvin ALOISE
Mirco COLOSI
Stefano CONOCI
Federico CROCE

Antonio D'INNOCENTE

Giovanni FARINA
Michele GENTILI
Simone LENTI
Luca MASSARELLI
Cristina MENGhini
Stefano PIERSANTI
Francesco SAPIO
Federico Maria SCAFOGLIERI
Emiliano SILVESTRI

XXXIV course

Marco BORESTA
Simone AGOSTINELLI
Edoardo ALATI
Graziano BLASILLI
Luca BORZACCHIELLO
Lorenzo BRIGATO
Carlos CARBONE
Stefano CARNÀ
Jim Martin CATAFORA OCANA
Jesus Fernando CEVALLOS MORENO
Paolo FANTOZZI
Marco FAVORITO
Mulham FAWAKHERJI
Lauren Stacey FERRO
Daniele FILOSCIA
Manuel NAMICI
Simone NICCHI

PhD theses completed in 2018

Federico FERRI

Computing Fast Search Heuristics for Physics-based Mobile Robot Motion Planning
Advisor: Fiora PIRRI

Valentina FRANZONI

A Unified Approach to Semantic and Topological Similarity in Information Networks
Advisor: Marco SCHAERF

Manuel Alejandro RUIZ GARCIA

Contact Aware Robust Semi-Autonomous Teleoperation of Mobile Manipulators

Advisor: Fiora PIRRI

Federico LOMBARDI

Autoscaling Techniques and Blockchain-based Architectures for Performant and Dependable Complex Distributed Systems

Advisor: Silvia BONOMI

Francesco RICCIO

Spatial Representation for Planning and Executing Robot Behaviors in Complex Environments

Advisor: Daniele NARDI

Mara SORELLA

Mining Dynamics of User Preferences in Complex Networks

Advisor: Aristidis ANAGNOSTOPOULOS

Daniele UCCI

Privacy-Preserving Data Sharing into Collaborative Environments

Advisor: Roberto BALDONI

Andrea VANZO

Supporting Situated Spoken Human-Robot Interaction Through Perceivable Context

Advisor: Daniele NARDI

2.5 Visiting Scientists and Scholars

DIAG hosts visiting scientists and scholars from all over the world. Here we list the visitors that spent at least one month at DIAG during 2018.

- Hector GEFNER, Universidad Pompeu Fabra, Barcelona, Spain, September - December 2018.
- Yves LESPERANCE, York University, Toronto, Canada, May - September 2018, December 2018 - January 2019.
- Henk F. MOED, independent researcher, Amsterdam, Netherlands, visiting professor within the PRIN 2015 Project DIAG, September-December 2018.
- Claude MOOG, Directeur de Recherche CNRS, Laboratoire des Sciences du Numérique de Nantes, France.
- Léopold SIMAR, Université Catholique de Louvain, Louvain la Neuve, Belgium, March - April 2018.

2.6 Seminars and Workshops

Many scientists are invited to deliver seminars at DIAG. Below we report the list of seminars for the year 2018, in chronological order. We also report the workshops and special scientific events organized at DIAG.

- January 10, 2018, Viviana Betti, Santa Lucia: *Resting State Networks as Spatio-Temporal Priors for Natural Vision*.
- January 11, 2018, Cinzia Daraio, Sapienza University of Rome, MORE@DIAG Seminars: *The Problem of Democratization of Evaluation and Altmetrics*.
- January 29, 2018, Keith Clark, Imperial College: *Rule Control of Teleo-Reactive, Multi-tasking, Communicating Robotic Agents*.
- February 2, 2018, AISM@DIAG: *Affrontare la Complessità della Sclerosi Multipla: dalla Medicina al Data Analytics*.
- February 21, 2018: *Automazione: La Figura Professionale dell'Ingegnere - Incontro tra Aziende e Studenti*.
- March 8, 2018, Henk Moed, MORE@DIAG Seminars: *New developments in Applied Evaluative Informetrics*.
- March 15, 2018, Mario Morroni, University of Pisa, MORE@DIAG Seminars: *Georgescu-Roegen's flow-fund model, uncertainty, innovation and the theory of the firm*.

- March 19, 2018, Minoru Asada, Osaka University: *Cognitive Developmental Robotics: Yesterday, Today, and Tomorrow*.
- March 19, 2018, Guglielmo Gemignani, Magazino GmbH: *Picked by a robot: Behavior Trees for real world robotic applications in logistics*.
- March 22, 2018, Omer Gold, Tel-Aviv University: *Tight Space Lower Bounds for Fault-Tolerant Approximate Diameter and Radius*.
- March 26, 2018, Massimiliano Carloni, Clarivate Analytics: *A Brief Introduction to Web of Science and InCites Basics*.
- April 4, 2018, Leonid Libkin, University of Edinburgh: *Can We Trust SQL as a Data Analytics Tool?*
- April 4, 2018, Christoph Neumann, Institute of Operations Research, Karlsruhe Institute of Technology, MORE@DIAG Seminars: *A Feasible Rounding Approach for Mixed-Integer Optimization Problems*.
- April 4, 2018, Oliver Stein, Institute of Operations Research, Karlsruhe Institute of Technology, MORE@DIAG Seminars: *The Cone Condition and Nonsmoothness in Linear Generalized Nash Games*.
- April 10, 2018, Steve Tumson, Tumson Consulting (Technology, Management, Education): *Regulating Robotics*.
- April 12, 2018, Divesh Srivastava, AT&T Labs-Research: *The Confounding Problem of Private Data Release*.
- April 12, 2018, *Cerimonia inaugurale Master di II livello in Ingegneria Gestionale per le Aziende Sanitarie*.
- April 18, 2018, Rolf Krause, MORE@DIAG Seminars: *Modeling, Simulation, and Uncertainty Quantification in Biomechanics*.
- April 19, 2018, Joe Halpern, Cornell University: *Actual Causality: A Survey*.
- April 23, 2018, Massimiliano Carloni, Clarivate Analytics: *InCites Laboratory*.
- April 26, 2018, *Roman Games 2: An Informal One-Day Workshop on Multiagent Optimization*.
- May 14, 2018, Giancarlo Bigi, University of Pisa, PhD course: *Algorithms for Nonsmooth Optimization*.
- May 21, 2018, Claudia Sarrico, OECD Paris: *The OECD Benchmarking Higher Education System Performance Project: Research questions and data opportunities*.
- May 24, 2018, Michela Taufer, University of Delaware: *Modeling the Next-Generation High Performance Scheduler*.

- May 25, 2018, Mateo Valero, University of Catalonia (UPC): *Runtime Aware Architectures*.
- May 28, 2018, Andrés Barreneche, OECD Paris, MORE@DIAG Seminars: *Innovation Policy and Governance, STI Policy Monitoring and Innovation for Inclusive Growth*.
- June 20, 2018, Amos Uderzo, Università di Milano-Bicocca, PhD course: *Metric Regularity of Set-Valued Mappings with Application to Optimization*.
- June 20, 2018, Markos Papageorgiou, Technical University of Crete: *Freeway Traffic Control*.
- June 26, 2018, Laura Astolfi, Sapienza University of Rome: *Connectivity Analysis based on EEG Recordings: from Motor Tasks to the Human Social Brain*.
- June 26, 2018, Endre Boros, Rutgers University: *Justifiable and Ethical Learning - a Mathematical View*.
- July 2, 2018, Fangzhen Lin, Hong Kong University of Science and Technology: *Program Verification in First-Order Logic*.
- July 9, 2018, Anton Shiriaev, Norwegian University of Science and Technology: *Trajectory Planning for Mechanical Systems with two and more Passive Degrees of Freedom*.
- July 19, 2018, Juan Cortés, LAAS–CNRS: *Sampling-Based Algorithms for Path-Finding in Continuous Cost-Spaces: Applications to Robotics and Structural Biology*.
- July 27, 2018, Matteo Cannavicchio, Roma Tre University: *From Information to Knowledge: An Overview of Public Available Knowledge Graphs*.
- September 9, 2018, Sven Wachsmuth, Bielefeld University: *Research Methodologies in Human Robot Interaction*.
- September 12, 2018, Luca Benvenuti (Sapienza University of Rome), Enrico Tronci (Sapienza University of Rome), Federico Mari (Sapienza University of Rome), Leonardo Mangeruca (United Technologies Research Center), Tiziano Villa (University of Verona), Davide Bresolin (University of Padova), ABRO PhD course: *Hybrid systems, Computation and Control*.
- September 13, 2018, Michael Lindenbaum, Technion: *3DmFV: 3D Point Cloud Classification in Real-Time using Convolutional Neural Network*.
- September 19, 2018 *Identificazione e Controllo Ottimo, Bioingegneria, Gestione del Traffico su Reti al DIAG, ieri, oggi e domani – A workshop in memory of Prof. Carlo Bruni*.
- September 21, 2018, Giuseppe Persiano, University of Salerno: *Symmetric Searchable Encryption with Sharing and Unsharing*.
- September 27, 2018, Pete Herzog, ISECOM: *Assessing Cyber Security for Complex Systems*.

- October 12, 2018 Rebecca Reiffenhauser, RWTH Aachen: *An Optimal Truthful Mechanism for the Online Weighted Bipartite Matching Problem.*
- October 16, 2018, Yiannis Giannakopoulos: *Optimality, Approximation and Robustness in Auctions.*
- October 16, 2018, Leonid Libkin, University of Edinburgh: *Certain Answers Meet Zero-One Laws.*
- October 18, 2018, Luca Trevisan, University of Berkeley: *A Theory of Spectral Clustering.*
- October 24, 2018, Jan Baumbach, Technische Universität Munchen: *Computational Systems Medicine - What I learned about Arnold Schwarzenegger while Studying Breast Cancer Survival.*
- November 8, 2018, Jonathan Fürst, University of Copenhagen: *IoT Edge Computing at NEC Labs.*
- November 15, 2018, Chris Nash, University of Leeds, Workshop: *Procurement Design of Local Public Transport Services.*
- November 27 2018, Mathias Staudigl, Maastricht University: *Hessian Barrier Algorithms for Linearly Constrained Optimization Problems.*
- November 29, 2018, Piotr Krysta, University of Liverpool: *Equal-Cost Mechanism Design with Monitoring.*

2.7 Honours and Awards

- M. Cattaneo, T. D’Alfonso, U. Panniello: Premio “Giovani AiIG”, Associazione Italiana Ingegneria Economico Gestionale, Project Proposal *Understanding the impact of the sharing economy on traditional industries: theory and evidence from the hospitality industry*, 2018.
- L. Iocchi, Canada-Italy Innovation Award 2018.
- S. Leonardi, *ERC Advanced Grant 2018 - 2023: AMDROMA - Algorithmic and Mechanism Design Research in Online Markets.*
- F. Rosato, CLUSIT 2018 Award for the best Italian M.Sc. Thesis in Cybersecurity of 2017: *Symbolic Execution of Malicious Software: Countering Sandbox Evasion Techniques.*
- S. Papandrea, A. Sterbini, M. Temperini, E. Popescu, Best Paper Award at ICWL2018 *Q2A-I: A Support Platform for Computer Programming Education, Based on Automated Assessment and Peer Learning*, In Proc. Int. Conf. on Web-based Learning, ICWL2018, LNCS 11007, Springer (2018).

- M. Angelini et al., Best Paper Award at VizSec2018 *ROPMate: Visually Assisting the Creation of ROP-based Exploits* 2018, IEEE Symposium on Visualization for Cyber Security (VizSec'18).
- P. Di Giamberardino, M. L. Aceto, O. Giannini, M. Verotti, Best Short Paper/Poster Award at ICINCO 2018, *Dynamic Estimation of Visco-elastic Mechanical Characteristics of Biological Samples under Micro Manipulation*, In Proc. of the 15th Int. Conf. on Informatics in Control, Automation and Robotics (ICINCO 2018).

2.8 Contracts

Researches carried on at DIAG are funded by public agencies and/or companies. Some of them span over many years. For each contract, we list below contractor, title, project leader, funding (in Euro), and duration. Titles of contracts funded by Italian entities are reported in Italian.

Contracts with the European Union (EU)

- ERC-AdG AMDROMA - Algorithmic and Mechanism Design Research in Online MArkets, S. Leonardi, € 1.780.150, ending 30-06-2023.
- H2020 COMANOID - Multi-contact Collaborative Humanoids in Aircraft Manufacturing, G. Oriolo, € 719.215, ending 31-12-2018.
- H2020 MSCA DOCMA - Disorders of Consciousness (DoC): Enhancing the Transfer of Knowledge and Professional Skills on Evidence-based Interventions and Validated Technology for a Better Management of Patients, F. Cincotti, € 126.000, ending 31-12-2021.
- H2020 MSCA FIRST - virtual Factories: Interoperation supporting business innovation, M. Mecella, € 207.000, ending 31-12-2020.
- FP7-CP FLEXSIGHT - European Clearing House for Open Robotics Development Plus Plus, D. Nardi and A. Pretto, € 116.500, ending 30-09-2018.
- H2020 FLOURISH - Aerial Data Collection and Analysis, and Automated Ground Intervention for Precision Farming, D. Nardi, € 366.750, ending 31-08-2018.
- ERC-StG RoboExNovo - Robots learning about objects from externalized knowledge sources, B. Caputo, € 1.496.277, ending 31-05-2019.
- H2020 ROCKEU2 - Robotics Coordination Action for Europe Two, D. Nardi, € 132.500, ending 31-01-2018.
- H2020 SCIROC - European Robotics League plus Smart Cities Robot Competitions, D. Nardi, € 300.000, ending 31-01-2022.

- H2020 SECONDHANDS - SecondHands: A Robot Assistant For Industrial Maintenance Tasks, F. Pirri, € 993.750, ending 30-04-2020.
- H2020 SYMPLEXITY - Symbiotic Human-Robot Solutions for Complex Surface Finishing Operations, A. De Luca, € 507.500, ending 31-12-2018.

Contracts with non-EU Institutions

- SNF (Fond National Suisse de la Recherche Scientifique) MEGANE-PRO - Myo-Electricity Gaze and Artificial Intelligence for Neurocognitive Examination and Prosthetics, € 215.670, B. Caputo, 31-01-2019.

Contracts with Italian Institutions

- FIRB 2013 Futuro in Ricerca - Stima della connettività inter-soggetto da registrazioni simultanee dell'attività neuroelettrica ed autonoma come strumento innovativo per lo studio dei meccanismi di interazione sociale nell'uomo, L. Astolfi, € 263.845, ending 14-03-2018.
- Ministero Sviluppo Economico- I4ALL - Internet for all, D. Nardi, € 62.692, ending 31-12-2018.
- MIUR-PRIN 2015-Comparing Governance Regime Changes in Higher Education: systemic performances, national policy dynamics, and institutional responses. A multidisciplinary and mixed methods analysis, C. Daraio, € 84.000, ending 05-02-2020.
- Regione Lazio ARCA - Academic Research Creativity Archives, M. Mecella, € 82.720, ending 07-02-2020.
- Regione Lazio DTC - Distretto Tecnologico per le nuove tecnologie applicate ai beni culturali, M. Mecella and M. Schaerf, € 62.224, ending 20-07-2020.
- Regione Lazio IncontraRicerca: un portale per favorire l'incontro tra la ricerca e le applicazioni, A. Marchetti Spaccamela, € 193.718, ending 7-8-2018.
- Regione Lazio URBEM - Urban Environment Management, B. Ciciani, € 35.000, ending 18-07-2019.

Contracts with Companies

- ACI Informatica SpA - Sperimentazione e realizzazione prototipale di sistemi tecnologici basati su ontologia per la gestione integrata di banche dati riguardanti i veicoli - Rif. CIG 66898173A1, M. Lenzerini, € 447.980, ending 28-07-2019.

- AREMOL- REGIONE LAZIO- Agenzia regionale per la mobilità Studio a supporto dei competenti uffici regionali per analisi sui servizi minimi del trasporto pubblico locale della Regione Lazio, G. Catalano, A. Avenali, G. Matteucci, € 35.000, ending 31-12-2019.
- CONEROBUS SpA - Attività di supporto alla committente nella valutazione delle risorse finanziarie richieste in fase di sviluppo della rete filoviaria del comune di Ancona, G. Catalano, A. Avenali, G. Matteucci, € 18.500, ending 30-06-2019.
- PRISMA SRL - Supporto per lo sviluppo del sistema CRUMBS e CRUMBS GDPR, da integrare all'interno della piattaforma Dominio di proprietà della parte Committente, G. Santucci, € 60.000, ending 26-08-2019.
- ROTA LASER - Esecuzione di una ricerca per lo studio delle tecnologie esistenti e l'analisi delle possibili soluzioni tecniche, la definizione dei blocchi funzionali, dell'architettura tecnica della Fustella 4.0, M. Massimo, € 144.580, ending 30-07-2019.
- Thales Alenia Space Italia SpA - Studio di nuove tecnologie per Sistemi Satellitari di Navigazione e Telecomunicazione, F. Delli Priscoli, € 51.983, ending 12-03-2018.
- Thales Alenia Space Italia SpA - Studio di nuove tecnologie per Sistemi Satellitari di Navigazione e Telecomunicazione, F. Delli Priscoli, € 21.878, ending 30-04-2018.
- Thales Alenia Space Italia SpA - Esecuzione attività di ricerca nell'ambito dei seguenti temi: 1) "Analisi e modelli in ambito ingegneria sistema satellite"; 2) "Modelli ed uso della propulsione elettrica in ambito spaziale", F. Delli Priscoli, € 29.255, ending 30-04-2018.

Research Agreements (Convenzioni)

- Azienda Ospedaliera - Complesso Ospedaliero S. Giovanni Addolorata, ending 24-3-2018.
- Braintrends S.r.l., ending 28-07-2020.
- CESVITER - Centro Internazionale di Studi per l'Innovazione e lo Sviluppo Territoriale, ending 2-2-2019.
- CINI Consorzio Interuniversitario Nazionale per l'Informatica, ending 30-05-2020.
- CRAT Consorzio per la Ricerca nell'Automatica e nella Telecomunicazioni (funding of 2 Post-Doc positions), ending 12-12-2018.
- CREA, ending 23-01-2020.
- DIS Dipartimento per la Sicurezza, ending 04-10-2018.
- ENAC (funding of 1 Post-Doc position), ending 27-11-2019.

- Fondazione S.Lucia, ending 13-10-2019.
- IASI-CNR, ending 28-07-2020.
- INEMA S.r.l., ending 23-3-2018.
- Ministero delle Infrastrutture e dei Trasporti, ending 26-07-2019.
- NCFU (economic support for PhD students), ending 31-10-2019.
- Project Management Institute - PMI, Rome Italy Chapter, ending 22-6-2018.
- Universitate do Porto, ending 23-1-2021.

3 Research Areas

The scientific activities of the Department cover six Research Areas, responsible for identifying and coordinating research programs and for supporting teaching activities. Each area includes one or several research groups. Research areas are:

- **Biomedical Engineering**
- **Economics**
- **Engineering in Computer Science**
- **Management Engineering**
- **Operations Research**
- **Systems and Control Engineering**

3.1 Biomedical Engineering

3.1.1 Bioengineering and Bioinformatics

Research lines:

- Analysis and Modelling of Metabolic Systems
- Methods and Techniques for Neuroengineering
- Bioengineering for Molecular Biology and Bioinformatics
- Processing and analysis of bioelectrical signals

Members: Laura Astolfi, Febo Cincotti (leader), Lorenzo Farina, Serenella Salinari (leader ad honorem, retired).

Post Docs: Angela Ciaramidaro, Manuela Petti, Jlenia Toppi.

PhD Students: Yuri Antonacci, Emma Colamarino, Marianna Inglese, Maria Grazia Puxeddu, Mirko Rossi.

The research activity in this area deals with the applications of the general methodologies of modelling, estimation, signal processing, machine learning and statistics to the study of physiological and biological systems. Researches on biomedical applications have been performed since the early 70's with regard to biomechanics, prostheses and modelling of cellular growth. At present, the group is engaged in a multidisciplinary effort, pursuing a wide range of research topics by developing mathematical methods applied to neurophysiology, to the analysis and integration of omics data, and by designing innovative instrumentation for neurorehabilitation.

The main research topics are:

- Modelling and Identification of tumor response to radiations;
- Analysis and modeling of insulin secretion and glucose metabolism;
- Estimation of cerebral connectivity in humans by means of structural and functional models and applications;
- Design and validation of EEG-based Brain-Computer Interfaces for assistive and rehabilitation purposes;
- Computational modeling and analysis of omics data.

Research goals include: the study of the mechanisms on the basis of insulin secretion and on the insulin resistance; the potential application of the Brain Computer Interface (BCI) techniques in the rehabilitation of stroke patients; the utilization of the neuroengineering tools in the field of the economy/marketing; the optimization of tumor radiotherapy, the development of computational and bioinformatic tools for the analysis of

omics data in different organisms and diseases, including berry developments in plants and human solid tumors.

Laura Astolfi received prestigious honors (Chair of the Technical Committee di IEEE EMBS in Biomedical Signal Processing since 2015, Fellow of the European Alliance for Medical and Biological Engineering Sciences (EAMBES), Member of the 2017-19 Administrative Committee of the IEEE Society of Engineering in Medicine and Biology, EMBS), and editorial activity (Member of the Scientific Board of the International Society for Brain Electromagnetic Topography – ISBET, Theme Chair for the Annual International Conference IEEE EMBC'18, Member of the Scientific Board of the IV IEEE Middle East Conference on Biomedical Engineering – MECBME2018, Member of the Scientific Board of the VI Congresso del Gruppo Nazionale di Bioingegneria – GNB2018).

Several national and international cooperations are actually active, among which: Dip. di Fisiologia Umana e Farmacologia, Sapienza Università di Roma; Dip. di Biotecnologie Cellulari ed Ematologia, Sapienza Università Roma; IRCCS Fondazione Santa Lucia (Roma); Istituto di Medicina Interna Università Cattolica - Policlinico A. Gemelli (Roma); Laboratorio di Oncogenesi Molecolare, Istituto Nazionale Tumori Regina Elena (Roma); Istituto di Analisi dei Sistemi e Informatica (IASI) – CNR (Roma); Istituto per le applicazioni del calcolo (IAC) – CNR (Roma); Laboratorio di Genetica Agraria, Dipartimento di Biotecnologie, Università di Verona; Institut del la Santé et de la Recherche Medicale-Unité 870 Faculté de Medicine Lyon; Conway Institute of Biomolecular and Biomedical Research University College, Dublin; Bariatric and Metabolic Surgery, King's College, London; Institute of Medical Statistics, Computer Sciences and Documentation, Friedrich Schiller University, Jena, Germany; Functional Brain Mapping Laboratory, University of Geneva, Switzerland; Perceptual Networks Group, University of Fribourg, Switzerland; Computational Cognitive Neuroscience Lab, Indiana University, Bloomington, USA; Dpt. of Biomedical and Electrical Engineering - University of South California (USA); ECE Kansas State University (USA); New Zealand Brain Research Institute, Christchurch, New Zealand.

Projects:

- *Brain-to-brain connectivity from simultaneous neuroelectric and autonomic multi-subjects recordings as a new tool to study human social interaction.* Progetto MIUR Futuro in Ricerca 2013, L. Astolfi.
- *Multimodal classification of upper limb movements during post-stroke rehabilitation.* Progetto di Ateneo - Avvio alla ricerca 2017, E. Colamarino.
- *MIME-BCI - Mindfulness mediatation.* Progetto di Ateneo 2016 - Interdisciplinare, F. Cincotti.
- *EMBRACING: Estimating Multiple-Brain connectivity in Autism during Cooperative Interaction: a new tool for real-time hyperscanning.* Progetto di Ateneo 2017, L. Astolfi.
- *MoRe-Net - MObility REcovery supported by hybrid Brain-Computer Interface and complex NETWORK theory* Progetti di ricerca congiunti per la mobilità di studenti di dottorato di ricerca, E. Colamarino, M. G. Puxeddu.

- *Sviluppo di algoritmi per l'analisi di potenziali evento-correlati in presenza di jitter.* Progetto di Ateneo 2018, L. Astolfi.
- *Network medicine based machine learning and graph theory algorithms for precision oncology.* Progetto di Ateneo 2018, L. Farina.
- *Synergies-based real-time monitoring to improve post-stroke rehabilitation.* Progetto di Ateneo - Avvio alla ricerca 2018, E. Colamarino.

3.2 Economics

3.2.1 Innovation, Internationalization and the Environment

Research lines:

- R&D and Innovation
- Migration and Innovation
- Renewable Energy Sources and Environmental Policies

Members: Francesca Sanna-Randaccio, Roberta Sestini.

Post Docs: Chiara Conti.

This group has investigated the theoretical explanations and empirical implications of some interrelated phenomena, namely, technological innovation - with a particular emphasis on R&D agreements -, location decision by firms in international oligopolies, environmental policies and their role in spurring innovation, and coalition formation in oligopolies. These topics combine two strands of research previously followed by some members of the group. A first line of analysis concerned the study of R&D investment decisions, applying optimal control and dynamic game methods. The other line of enquiry dealt with different aspects of firms' international strategy choices following a game-theoretic approach.

Currently the following research topics are under investigation by the group's members:

Endogenous R&D Agreements over Time We introduced a new class of models of endogenous agreements between firms under imperfect competition in which also the timing of actions is made endogenous. The purpose was to bridge two usually separate streams of literature, the noncooperative formation of alliances (R&D agreements, mergers etc.) and the endogenous timing literature. This allowed to consider the formation of firms' agreements over time. The models are currently also employed to study the endogenous formation of environmental agreements among different countries.

Innovation and Diffusion of Clean Technologies This stream of empirical research is motivated by the increased concern that the fragmentation of EU renewable energy research and innovation systems may hamper the ability to address climate challenges at socially acceptable costs. We build a knowledge diffusion econometric model to investigate the intensity and direction of knowledge spillovers in the strategic field of renewable energy technologies. In particular we examine the pattern and evolution of knowledge flows within the EU and between the EU and two frontier innovators: the US and Japan. We assess whether demand-pull environmental measures (starting from the 1997 Commission White Paper and following Directives) had an impact on the fragmentation of EU research and innovation space. Our results provide suggestive, but convincing evidence

that the reduction in fragmentation emerged as a result of the EU support for renewable energy technologies.

Strategic formation of R&D agreements in presence of spillovers and informational asymmetries This research line aims to analyze firms' incentives to invest in R&D under uncertainty and imperfect appropriability of the results of the research process. In particular, we investigate the extent to which firms' R&D productivity and R&D spillovers affect the decision to sign agreements aimed to cooperation in R&D activities. For this purpose, we use a game-theoretical oligopoly model to identify the mechanisms underlying firms' strategic decisions. The results obtained from the theoretical model contribute to explain some puzzling empirical evidence regarding the formation and the features of R&D cooperation agreements (such as RJVs). Moreover, we find a signaling role of cooperation agreements, able to foster efficient outcomes and welfare improvement. This confirms the importance of policies encouraging R&D collaboration among firms.

Migration, externalities and innovation This strand of research is motivated by the importance to analyze the effects and the implications of migration on firms' innovative performance and strategic competitiveness, with a focus on Italian sub-regions. This research, although focused on a single country, can be informative also for other countries with a similar economic structure, which are likely to be affected by large immigration in the near future. The study is conducted using advanced econometric models supported by patent data and firms' self-reported innovation measures (CIS data), and focuses on the role of substitution or complementarity between natives' and migrants's skill structure. A particular attention is devoted to the possible consequences of the inflow of cheap labor force in a country specialized in traditional, low value-added production. The estimation results do not show any significant negative effect on innovation, thus suggesting that low-skilled immigration does not represent a real shock in labor supply.

3.3 Engineering in Computer Science

3.3.1 Algorithm Design and Engineering

Research lines:

- Principles of Design and Analysis of Algorithms
- Experimental Algorithmics
- Software performance analysis
- External Memory and Streaming Algorithms for Massive Data Processing
- Incremental Algorithms and Dynamic Data Structures
- Approximation and On-line Algorithms
- Algorithmic Game Theory
- Algorithmic approaches for bioinformatics and elearning

Members: Aris Anagnostopoulos, Giorgio Ausiello (leader ad honorem, emeritus), Fabrizio D'Amore, Camil Demetrescu (leader), Stefano Leonardi, Alberto Marchetti-Spaccamela, Umberto Nanni.

Post Docs: Daniele Cono D'Elia, Emilio Coppa, Andrea Ribichini.

Research activity regarding design and engineering of computer algorithms and computational complexity analysis has been developed at DIAG since when the Department has been created in the early Eighties. In the first years the emphasis has been on theoretical aspects such as those related to the notion of approximation preserving reductions among optimization problems and the classification of optimization problems based on their approximability properties. Subsequently, research activities have evolved in various directions according to the evolution of information technology and of application domains. New emerging topics have been addressed such as dynamic graph algorithms, on line algorithms, external memory, and streaming algorithms for massive data sets. Also the emphasis of the approach has changed moving from traditional worst case analysis to experimental performance analysis.

The most relevant recent results include contributions in the following areas:

- Principles of Design and Analysis of Algorithms: re-optimization techniques for combinatorial problems, models of computation for very large data sets;
- Experimental Algorithmics: implementation and engineering of advanced algorithms and data structures for graph problems;
- Performance Engineering: design and implementation of methodologies and tools for analyzing and optimizing software systems;

- External Memory and Streaming Algorithms for Massive Data Processing: external-memory and streaming algorithms for very large graph problems;
- Incremental Algorithms and Dynamic Data Structures: incremental algorithms for path problems in graphs;
- Approximation and On-line Algorithms: scheduling algorithms, algorithms for metabolic networks, vehicle routing, approximation algorithms for rent-or-buy network design problems, on-line algorithms for stochastic optimization problems such as Steiner tree and set cover under several models;
- Algorithmic Game Theory: quality of strong equilibria in network formation games under restricted communication model;
- Algorithmic approaches for bioinformatics and elearning: application of algorithmic models and techniques to bioinformatics and elearning.

In the future we plan to tackle fundamental problems arising in emerging applications involving the analysis and optimization of networks, real-time systems, scheduling and resource allocation, as well as in other areas. Special emphasis will be given to problems on very large data sets and multi-core platforms. In particular, our research goals include:

- External Memory and Streaming Algorithms for Massive Data Processing: external-memory and streaming algorithms for problems arising in the dynamic analysis of large software systems and networks. Among other goals, we plan to investigate novel approaches to performance profiling and optimization based on provably efficient streaming techniques;
- Incremental Algorithms and Dynamic Data Structures: we will study efficient incremental change propagation techniques for constraint-based systems on multi-core platforms;
- Approximation and On-line Algorithms: we aim at investigating the complexity and the approximability of combinatorial resource allocation problems, with a focus on problems arising from the scheduling of recurrent tasks in real-time systems. In particular, we aim at the design and analysis of efficient tests of feasibility for the scheduling of tasks on multiprocessor platforms. We will push further the study of on-line algorithms for stochastic optimization problems. We'll also consider the simultaneous approximation on several objective functions and on network instances;
- Algorithmic approaches for bioinformatics and elearning: several models and techniques, studied and evolved within the area of algorithm engineering turned out to be very pervasive. In various contexts these has lead to effective solutions to problems with complex structure. In the last years we have devised representations, based on graphs and hypergraphs, suitable to model processes and biological systems. Then, working with groups of researchers in other disciplines - such as bioinformatics and elearning - we aim at boosting research results in these areas.

Giorgio Ausiello is editor of the following journals:

- Theoretical Computer Science - Series A.
- Computer Science Review.
- SN Computer Science.
- co-Editor in Chief of the ARCoSS series of Springer Lecture Notes in Computer Science.

3.3.2 Algorithms and Data Science

The group of Algorithms and Data Science performs theoretical and applied research in the areas of algorithms and data science. There is particular interest in the design of algorithmic techniques for the analysis of very large volumes of data and for the economics of the internet, as well as in the algorithmic modeling of complex systems.

Research lines:

- Algorithms
- Data Science
- Big Data
- Algorithmic Game theory
- Mechanism Design
- Data Mining
- Social Networks
- Recommender Systems
- Economics and Computation
- Algorithmic Data Analysis
- Streaming
- Network and Stochastic Processes
- Random Structures

Members: Aris Anagnostopoulos, Luca Becchetti, Stefano Leonardi (leader).

Post Docs: Adriano Fazzino, Chris Schwiegelshohn.

PhD Students: Giorgio Barnabò, Federico Fusco, Michele Gentili, Leonardo Martini, Cristina Menghini, Stefano Piersanti, Mara Sorella.

Projects:

- *Algorithmic and Mechanism Design Research for Online Markets (AMDROMA)*, ERC Advanced Grant 2018 - 2023, S. Leonardi.

3.3.3 Artificial Intelligence and Knowledge Representation

Research lines:

- Description Logics
- Logics for AI
- Semantic Technologies
- Reasoning about Actions & Planning
- Spoken Language Understanding

Members: Luigia Carlucci Aiello, Giuseppe De Giacomo (leader), Domenico Lembo, Maurizio Lenzerini, Paolo Liberatore, Daniele Nardi, Fabio Patrizi, Antonella Poggi, Riccardo Rosati.

Post Docs: Lorenzo Lepore, Marco Ruzzi, Valerio Santarelli, Domenico Fabio Savo.

PhD Students: Gianluca Cima, Federico Croce, Marco Favorito, Marina Morelli, Federico Maria Scafoglieri, Andrea Vanzo.

Other Collaborators: Giacomo Ronconi.

Research in Artificial Intelligence at DIAG started in the early 80s and established this research group as one of the most prominent ones in the field of logic-based knowledge representation and automated reasoning. Research has been conducted in many areas, with several outstanding results. The research lines presently active are described in the following.

Description Logics (DL) form a family of Logic-based Knowledge Representation Languages which allow for modeling an application domain in terms of objects, concepts and relationships between concepts, and for reasoning about them. They are widely used in several areas, including ontology engineering, Semantic Web, and information integration. The research at DIAG on DL has a long tradition, and focuses on many relevant aspects, including algorithms for automated reasoning, trade-off between expressive power and computational complexity of reasoning, query answering in DL knowledge bases, adding both monotonic and non-monotonic rules to DL. In the future, the work on DL will both continue along the above mentioned lines and focus on dynamic aspects, such as update and revision of DL knowledge bases, and reasoning about programs expressed on such knowledge bases.

The Semantic Technologies aim at intelligent information processing by creating and connecting machine-understandable information, sometimes called the Semantic Web. Our research in this area mainly focuses on representation languages, in particular for ontologies. A remarkable outcome of our research in this area is the standardization of the OWL 2 QL ontology specification language by the World Wide Web Consortium.

OWL 2 QL directly derives from DL-Lite, a family of ontology formalisms which we proposed and studied in our recent research in this field.

Reasoning about Actions concerns the theory and the implementation of agents that reason, act and perceive in changing, incompletely known, and unpredictable environments. Such agents must have higher level cognitive functions that involve reasoning, for example, about goals, actions, when to perceive and what to look for, the cognitive states of other agents, time, collaborative task execution, etc. Our research on Reasoning about Actions focuses on several aspects, including: foundations of theory of actions; various forms of planning or automated process synthesis for sophisticated dynamic properties, e.g., expressed in mu-calculus, ATL, LTL, LTL_f , and LDL_f ; high-level agent programs, like ConGolog based on the Situation Calculus; agent behavior synthesis and composition. This research is also related with, and applied to, other areas, such as cognitive robotics, multi-agent/multi-robot systems, software service modeling, execution and composition, high-level programs and business processes over ontologies and data sources.

One specific application where knowledge representation has been applied is Spoken Language Understanding in the context of Robotics. Specifically, we have addressed the interpretation of spoken commands and the extension to handle more complex forms of dialog. The knowledge about the environment and the robot capabilities are used by the system in order to build the language that specifies robot commands. Moreover, the knowledge about the environment (semantic map), can be used to bias the interpretation of commands through a spoken language command interpretation chain that is based on statistical off-the-shelf tools.

Several group members are recipients of prestigious awards, are regularly involved in editorial activities of the scientific community, and are invited to deliver keynote talks at international conferences or workshops.

Awards and honours include: AAAI Fellowships: Maurizio Lenzerini, since 2017; Giuseppe De Giacomo, since 2016; Luigia Carlucci Aiello, since 1995; EurAI Fellowships: Riccardo Rosati, since 2016, Giuseppe De Giacomo, since 2012, Daniele Nardi, since 2009, Maurizio Lenzerini, since 2008; Luigia Carlucci Aiello, since 1999; Membership to the *European Academy of Sciences and Arts* (Luigia Carlucci Aiello, since 2005); ACM Fellowships (Maurizio Lenzerini, since 2009; Giuseppe De Giacomo, since 2016); Membership to the *Academia Europaea –The Academy of Europe* (Maurizio Lenzerini, since 2011); IJCAI *Distinguished Service Award* (Luigia Carlucci Aiello, 2009); ECCAI *Distinguished Services Award* (Luigia Carlucci Aiello, 2014); Doctorate Honoris Causa (Luigia Carlucci Aiello, 2002, School of Technology, University of Linköping, Sweden); ACM *Recognition Service Award* (Maurizio Lenzerini, 2011).

Several group members are involved in various prestigious editorial activities: Giuseppe De Giacomo is Review Editor of *Artificial Intelligence* (Elsevier) and member of the Editorial Board of *Acta Informatica*, he is Vice-President of the Steering Committee Member of the *International Conference on Principles of Knowledge Representation and Reasoning* (KR), he is Area Chair of the *33rd AAAI Conference on Artificial Intelligence* (AAAI 2019) and Senior Program Chair of *28th International Joint Conference on Artificial Intelligence* (IJCAI 2018); Domenico Lembo is Vice-president of the Steering Committee Member of

the *International Conference on Web Reasoning and Rule Systems* (RR). Maurizio Lenzerini is Area Editor of *Information Systems – An International Journal*, for the area of Data Modeling and Knowledge Representation and Reasoning Techniques, Editorial Board member of *Intelligenza Artificiale*, The International Journal of the AI*IA, Area Editor of the *Journal of Applied Logic* for the area of Logic for Knowledge Representation and the Semantic Web, Editorial Board member of the *Logical Methods in Computer Science (LMCS) Journal*, for the areas of Database Theory and Logic for Knowledge Representation, and Area Editor of the *Logic Journal of the Interest Group in Pure and Applied Logic (IGPL)*, for the area of Logic for Knowledge Representation and the Semantic Web, he has been co-Chair of the 29th *International Workshop on Description Logics* (DL 2016), since 2011 he is Member of the ACM SIGMOD Awards Committee, since 2006 he is Member of the Executive Committee of the ACM Principles of Database Systems (PODS), and since 2005 he is Member of the *Sistemi Evoluti di Basi di Dati* (SEBD) Steering Committee, he is also Member of the Scientific Advisory Board of *BiCi – Bertinoro international Center for Informatics* and Member of the Advisory Board of the *European Research Institute in Service Science (ERISS)*.

Riccardo Rosati is Member of the Editorial Board of *Artificial Intelligence* (Elsevier), Steering Committee Member of the *International Workshop on Nonmonotonic Reasoning (NMR)*, since 2012.

Finally, the following invited talks were delivered:

- Giuseppe De Giacomo, *Foundations of Planning for LTLf and LDLf Goals*, invited talk at Rice University Houston, TX, USA, January 31, 2018;
- Giuseppe De Giacomo, *Reasoning About Actions: From Automata to LTLf/LDLf Synthesis and Planning* invited PhD course at 17th Estonian Summer School on Computer and Systems Science Roosta Holiday Village, Estonia, August 19th-23th 2018;
- Giuseppe De Giacomo, *Reasoning and Planning for LDLf/LDLf goals*, invited talk at the 33rd Italian Conference on Computational Logic. Bolzano, Italy, September 20-22, 2018;
- Giuseppe De Giacomo, *Foundations for Restraining Bolts: Reinforcement Learning with LTLf/LDLf Restraining Specifications*, invited talk at Rice University Houston, TX, USA, October 23, 2018;
- Domenico Lembo invited Lecturer on Data Integration at the EDBT 2017 summer school, Genoa, Italy, September 2017;
- Domenico Lembo, Valerio Santarelli and Domenico Fabio Savo *Methods and Tools for Developing Ontology-Based Data Access Solutions* tutorial at the 16th International Semantic Web Conference (ISWC 2017), Vienna, Austria, October 2017.

Projects:

- *ICE : Immersive Cognitive Environments*, Award Sapienza research project, December 2015 - December 2018, G. De Giacomo.

3.3.4 **Artificial Intelligence and Robotics**

Research lines:

- Artificial Intelligence and Robotics
- Robot Perception
- Cognitive Robotics
- Simultaneous Localization and Mapping
- Multi-Agent and Multi Robot Systems
- Semantic Knowledge for Robots
- Robot Competitions and Benchmarking
- Sensor Calibration
- Human-Robot Interaction
- Mobile Robot Navigation
- Robot Planning and Learning
- Social Robotics
- Reinforcement Learning
- Information Fusion
- Robot Security

Members: Giorgio Grisetti, Luca Iocchi, Daniele Nardi (leader), Alberto Pretto.

Post Docs: Roberto Capobianco.

PhD Students: Dario Albani, Irvin Aloise, Lorenzo Brigato, Carlos Salvador Carbone Lorio, Jim Martin Catacora Ocana, Mirco Colosi, Bartolomeo Della Corte, Mulham Fawakherji, Paola Ferrarelli, Marco Imperoli, Wang Lun, Ciro Potena, Francesco Riccio, Dominik Schlegel, Andrea Vanzo, Ali Youssef.

The research in this area is at the intersection between Artificial Intelligence and Robotics, and has its roots in the early AI research that targeted robots as embodiments of the intelligent agent.

The key scientific challenge, which has received a significant push by the recent developments in sensor technology and robotics, is the ability to deal with manifold representations of knowledge that enable robots to perform complex tasks in a dynamic, unknown environment populated by other (robotic and human) agents. One section of the work

aims at analyzing perceptual data to create a rich world model, through the interpretation of sensor data and/or data coming from other information sources, including spoken language understanding. Another section of the research aims at developing various types of inference to support the actions of the robot in the environment, in particular within social contexts and in the interaction with the user. Both perception and action are often addressed in scenarios where multiple agents cooperate both in distributed perception and in task execution.

The research group builds on the experience acquired through robotic competitions in the context of RoboCup, started back in 1998, not only in robot soccer, but also in Rescue, @Home and @Work competitions. Hence, one characterizing aspect of the research approach is a strong emphasis on the experimental validation of the proposed technical solutions through the implementation of system prototypes and their evaluation through suitable benchmarking methodologies.

The application domains, where the research ideas have been tested and experimentally evaluated, include virtual agents and multi-robot systems in soccer, emergency response robots, surveillance, agriculture and service robots. Specifically, the problem of sensor fusion and situation awareness has been targeted in the framework of maritime surveillance.

Several open-source hardware and software components and data sets are released and listed in our Web site www.diag.uniroma1.it/~labrococo. They include the design of a small mobile robot MARRtino, the software libraries Petri Net Plans, soccer robot vision applications (GNAO), IMBS, PHIS, PTracking, NICP, IMU-TK, D2CO, Easy-DepthCalibration, and the data sets data sets for maritime surveillance (MarDT), and the spoken language processing chain LU4R (in collaboration with Univ. Tor Vergata) and the data set for spoken command understanding (Huric).

The group has a solid tradition of cooperation with other research groups worldwide, and is very interested in establishing new collaborations and hosting foreign researchers:

- Prof. Mary Ellen Foster, University of Glasgow (UK), February - May 2018.

and foreign students:

- Ashley Oldershaw - University of Leeds (UK).
- Carlos Ibanez Cuadal - University of Barcelona (Spain).
- Liang Changhao - Nankai University (China).
- Zhang Jiashi - Nankai University (China).

Events (organized by the group):

- OberSeminar, Gaeta, May 2018.
- Artificial Intelligence for Human-Robot Interaction AAAI Fall Symposium, Arlington, Virginia USA, October 18 - 20, 2018.

- European RoboCupJunior 2018 Championship, Montesilvano (PE), Italy - May 29 - June 1, 2018.
- European RoboCup@Home Education 2018, Montesilvano (PE), Italy - May 29 - June 1, 2018.
- EduRobotics 2018, Rome, Italy - October 11, 2018.

Other activities:

- Daniele Nardi, Invited Talk at the General Artificial Intelligence Conference, Lussemburg, September 2018.
- Luca Iocchi and Daniele Nardi have been members of the Board of Trustees of the RoboCup Federation, 2018.
- The SPQR team of humanoid soccer players participated in RoboCup 2018 Standard Platform League, Montreal Canada, obtaining the the third place in the penalty kick challenge.
- The SPQReL team (joint team with University of Lincoln, UK) participated in RoboCup@Home 2018, Montreal Canada.

Projects:

- *Flourish* (EU Horizon2020), March 2015 - August 2018, A. Pretto, G. Grisetti, and D. Nardi.
- *Flexsight* (EU FP7, Experiment in ECHORD++), September 2016 - March 2018, A. Pretto, and D. Nardi.
- *RockEU2* (Horizon 2020 programme), February 2016 - August 2018.
- *SCIROC* (Horizon 2020 programme), Agreement signed in 2017, the project will span through February 2018 - January 2022.
- *Internet4All* (MISE project), January 2017 - December 2018.
- *Public Demonstrations of Social Robots in Public Environments* - funded by Leonardo SPA, 2018.

3.3.5 Computer Networks and Pervasive Systems

Research lines:

- Wireless and Sensor Networks
- Networks of Resource Constrained Devices
- Self-* Protocols and Systems
- People Centric Sensing
- Internet of Things
- Decentralized Applications
- Blockchain Technologies

Members: Luca Becchetti, Roberto Beraldi, Ioannis Chatzigiannakis, Alberto Marchetti Spaccamela (leader), Leonardo Querzoni, Andrea Vitaletti.

PhD Students: Fabio Angeletti.

The miniaturization of electronic devices and the advancements in telecommunications, make it possible the realization of ubiquitous pervasive systems, i.e. systems in which information processing has been thoroughly and transparently integrated into everyday objects and activities. These systems are composed of heterogeneous tiny artefacts such as wireless sensor nodes, RFID and NFC tags and readers, mobile phones etc. Such devices are often constrained in their computational and energy resources and are often organized in networks that do not rely on wired infrastructures and that contribute to the realization of the Internet of Things (IoT).

The realization of such systems requires new solutions in the design of algorithms and protocols for wireless ad hoc networks connecting large numbers of devices. Such networks might be very large and operate in a highly dynamic environment: sensor nodes move, enter and exit the system and are prone to faults, while communication links are often noisy and unreliable. As a consequence, adopted solutions should be simple, efficient, and robust; in particular, since energy is usually provided by batteries, energy efficiency must always be considered as a primary goal. The scale and nature of pervasive systems requires networks able to react to unexpected events and to operate beyond the complete understanding and control of the designer and of the user. In fact, these systems should achieve an appropriate level of self-organization and integration to adapt to continuously changing environments and to cope with unforeseen faults.

Our research focuses on the design, analysis, experimentation and implementation of algorithms and protocols for the Internet of Things.

We are also interested in solving complex communications primitives such as service discovery and event-based data diffusion, with the final goal of characterizing sensors

networks as a data storage and retrieval. In these context, interesting security and privacy issues emerge that due to the limited resources and the distributed nature of the applications, require the development of new techniques and algorithms. We complement our research with an extensive experimental work that is based on simulations (using network simulators such as NS2, OMNET++ and Shawn), and on test-beds (e.g. we run a permanent test-bed of wireless sensor network to monitor the ancient roman remains at the basement of DIAG and we have about 600 active tags to collect and analyse the so called proximity graph, namely a graph in which nodes are users and there is a link between two nodes if their are in proximity).

More recently we have started a research activity on decentralized applications and the employment of blockchain technologies to support the development of a new distributed architectures beyond the classical client/server paradigm

3.3.6 Computer Vision, Computer Graphics, and Perception

Research lines:

- Visual Search and Execution Monitoring
- Action and Activity Recognition, Anticipation and Forecasting.
- Memory and next step prediction in Long Short Time Memory (LSTM) Networks
- Scene Representation, Interpretation and Understanding
- Augmented Reality
- Human Motion Analysis, Gesture Recognition, Physics based methods, Activity Understanding from 3D data
- Dense Image Fusion, Meshing, 3D Surface Reconstruction
- Terrain Traversability in Rescue Environments

Members: Luigi Freda, Valsamis Ntouskos, Fiora Pirri (leader), Marco Schaerf.

PhD Students: Edoardo Alati, Federico Ferri, Manuel Alejandro Ruiz Garcia, Elham Omrani, Francesco Puja, Marta Sanzari, Mahdiah Izadpanahkakhk.

Collaborators: Lorenzo Mauro, Simone Grazioso.

The Computer Vision, Computer Graphics and Perception group is a multidisciplinary team of researchers that investigates several knowledge areas and apply them to scientific problems in many contexts. The team works on several topics related to Computer Vision and Graphics:

Visual Search — Visual search of relevant targets in the environment is a crucial robot skill. Our research group investigates this topic by proposing a number of frameworks for the execution monitor of an agent task (described in the next section), taking care of the agent attitude to visually search the environment for targets involved in the task. Visual search is also relevant in the field of artificial Intelligence for robotics and find one of its best application in the task of recovering from a failure. Our works exploit deep reinforcement learning to acquire a common sense scene structure and it takes advantage of a deep convolutional network to detect objects and relevant relations holding between them.

Visual Execution Monitoring — The execution and monitoring of high-level robot actions in a real environment can be concretely enhanced addressing the problem with a hybrid deterministic/nondeterministic state machine streaming perceptual information, strengthened by visual search and recognition. Our research line focuses on the great results of deep learning, which allow to strongly rely on visual

perception, for both monitoring the state of the world in terms of preconditions and postconditions that hold before and after the execution of an action and using a search policy to either guide where to look at or to refocus in case of a failure.

Action and Activity Recognition, Anticipation and Forecasting — Different works in literature afford the problem of Actions and Activities Recognition, Anticipation and Prediction in videos. The complexity of the problem requires the consideration of many aspect. First of all, the recognized action sequence has to be consistent with the final task of the whole activity. Furthermore, much attention needs to be given to the prediction of the correct action in those instances where specific sequences are under represent in the dataset not because of the likelihood of them to happen. Finally, several implementation problems, caused by the large dimension of the data used, need to be addressed. Our researched work focused on tackling those problems producing a novel network, the Anticipation and Forecasting Network (AFN).

Memory and next step prediction in Long Short Time Memory Networks — Following the line of work presented in the above section we particularly placed much attention to the behavior of LSTMs in keeping past information through the various iterations. In the context of action forecasting this is a crucial step to address since the forecasting step is possible only if the relevant information are kept in memory. We also focused our attention on understanding the relation between the features of past sequences and future steps both mathematically and in the practically in the available datasets.

Scene Representation and Interpretation — In order to deal with real environment and complex tasks and problems, there is the necessity of having an optimized scene representation to deal with. This kind of representation needs to be at the same time parsimonious and full of information. Therefore, our research group investigates possible representations as Mental Maps, which exploits the semantic, geometrical and ... information kept by a semantic segmentation that includes only the elements that could be useful to the agent to achieve its task.

Object Detection and Instance Segmentation — Object detection is the task of detecting instances of certain object classes (such as humans, buildings or cars) in digital images and videos. Well-researched sub-tasks include face detection and pedestrian detection. Instance segmentation is the task of grouping parts of the image that belongs to the same entity or class. In the field of research that combines Object Detection and Instance Segmentation, a new approach is proposed: from the classical machine learning algorithms, the research community moved to a neural network approach via the use of several new architecture. Inspired from, first, Faster-RCNN network developed by Ren, Shaoqing and He, Kaiming and Girshick, Ross and Sun, Jian (2015) and, then, Mask-RCNN developed by He, Kaiming and Gkioxari, Georgia and Dollár, Piotr and Girshick and Ross (2017), our research focused on developing new architectures by improving performances, computation time, capacity and multi-tasking properties.

Scene and Context Understanding — The problem of enabling an agent to perceive and understand the surrounding environment is not limited only to a correct representation via a semantic segmentation. A set of objects and a number of structural or contextual scene details can define a context. This information is crucial to infer some information but, even more, to disambiguate the increasing uncertainty that each prediction introduces in the prediction system. Therefore, our research group investigates the algorithms, both of classical machine learning and deep learning, to extract contexts from the analysed data and allow big frameworks to operate correctly with an enriched knowledge of the world.

Augmented Reality — Within the context of our research activities, Augmented Reality is becoming a compelling technology mainly for the interactive 3D visualization. First, it was used in the context of archaeological sites on hand-held devices and for building of complex planning scenarios for robots, eliminating the need to model the dynamics of both the robot and the real environment as it would be required by whole simulation environments. Then, relevant applications in this field are related to the augmentation of real environments with additional elements. Our research on these topics is mainly focused on the use of generative models and, in particular, Generative Adversarial Models.

Dense Image Fusion, Meshing, 3D Surface Reconstruction — In the field of Object Reconstruction, a new approach is proposed for 3D modeling of articulated objects, specifically animals, using both components and component aspects. A component of an articulated object is defined here to be that part of it, which is only partially deformable. An aspect is defined as a view of the component from a specific vantage point. Aspects are fixed for an object component. Each aspect is modeled from a single image, using an inflation algorithm and the deformation paradigm. Then aspects are blended and merged together to form the whole component.

Gesture Recognition from 3D data — The problem of Human Primitives Recognition is investigated, in our research work, within Motion Capture sequences. In this context, we investigated methods based on Gaussian Process Latent Variable Models and Alignment Kernels. We propose a new discriminative latent variable model with back-constraints induced by the similarity of the original sequences. We compare the proposed method with methods based on Dynamic Time Warping and with V-GPDS models, which are able to model highly dimensional dynamical systems. Another line of work is to recognize human actions, starting from a 3D input data sequence, independently from the camera point of view and from the physical aspect of the person under examination. To face this problem, Kernelized Temporal Cut is used for segmenting the sequence and finding cut points among different actions. Then, a spatio-temporal manifold model is used for representing the time series data and a spatio-temporal alignment algorithm is introduced in order to find matches between action segments.

Terrain Traversability in Rescue Environments — 3D Terrain understanding and structure estimation is a crucial issue for robots navigating rescue scenarios. Unfortu-

nately, large scale 3D point clouds provide no information about what is ground, and what is top, what can be surmounted and what can be not, what can be crossed, and what is too deep to be traversed. In this context, this research work mainly concentrated in providing methods for point cloud structuring which can lead to a definition of traversability cost maps.

Projects:

- *RoboExNovo - Robots learning about objects from externalized knowledge sources* - 2015, 2020 - ERC-2014-STG.
- *SecondHands - A Robot Assistant for Industrial Maintenance Tasks* - 2015, 2020 - H2020 ICT-2014-1.
- *TRADR - Long-Term Human-Robot Teaming for Robot Assisted Disaster Response* - 2014, 2018 - FP7 ICT 609763.

3.3.7 Cybersecurity

Research lines:

- Malware Analysis
- Security for cyber-physical systems
- Security governance
- Data privacy and security
- Threat intelligence

Members: Roberto Baldoni, Roberto Beraldi, Silvia Bonomi, Fabrizio d'Amore, Francesco Delli Priscoli, Camil Demetrescu (leader), Alessandro Di Giorgio, Luca Iocchi, Riccardo Lazzeretti, Domenico Lembo, Alberto Marchetti Spaccamela, Massimo Mecella, Antonio Pietrabissa, Leonardo Querzoni, Riccardo Rosati, Giuseppe Santucci.

Post Docs: Marco Angelini, Claudio Ciccotelli, Daniele Cono D'Elia, Emilio Coppa, Francesco Liberati, Domenico Fabio Savo, Mara Sorella.

PhD Students: Luca Borzacchiello, Lorenzo Brigato, Roberto Germana', Alessandro Giuseppi, Giuseppe Laurenza, Simone Lenti, Luca Massarelli, Simone Nicchi, Andrea Tortorelli.

The cybersecurity group is a multidisciplinary team of researchers that collates several knowledge areas and apply them to scientific problems in the context of IT security. The team works on several diverse topics related to cybersecurity, including:

Attack modeling — Among all the existing Attack models, Attack graphs represent a nice abstraction to capture the notion of multi-step attack i.e., an attack toward a specific target executed taking intermediate steps in which the attacker compromise several entireties and exploits their vulnerability to reach the target. Several attack graph representations exist in literature but they suffer the same limitation: they are poorly scalable and consider only vulnerability related to the underling network infrastructure. We study how to improve the scalability of the attack graph generation process and how to enrich the attack graph with other types of information (e.g., application vulnerabilities, human vulnerabilities, etc.).

Binary similarity — Different works in literature afford the problem of binary similarity: given the binary code of two different functions they try to understand if these two binaries have been compiled from the same source. The problem has a large number of potential applications, but it is not trivial because the source code can be compiled with different compilers on different platforms, or the compiler can use different optimizations. We study how we can generalize this definition of similarity using deep learning. In particular, we aim at identifying semantic similarities among compiled functions to support malware analysis.

Blockchain — Blockchain is an emerging paradigm that allows to store data in a fully decentralized system guaranteeing data integrity and transparency in the data flow. Actually, several technologies exist that allow users to develop and deploy his/her own blockchain. We are studying issues related to blockchain scalability (in terms of achieved performance) and security against external attacks.

Cyber-physical systems — Protection and preventive control of cyber-physical systems via model-based control-theoretical approaches. Robust control and model predictive control are being utilized to safely operate complex systems, such as SCADA? controlled Critical Infrastructures (e.g., Power Networks), in order to assure service resilience and operational efficiency. On a related research line, we study novel solutions for the protection of IoT devices from external malicious interactions based on the behavioral analysis of the attacker.

Evasive malware — Sandboxes are a staple of modern malware detection and analysis techniques. However, malware writers over the years have adapted their strategies in order to have malicious samples hide their true colors when executing in such analysis environments. Fingerprinting techniques are employed to detect distinctive features of sandboxing products or even better of the virtualization technologies they rely upon. We investigate how dynamic binary instrumentation can be used to detect evasive attempts by malware samples, and fake the results provided by the execution environment in order to give a sample the illusion that it is executing in a non-hostile environment, or in a very specific hardware and software configuration in the case of APT malware.

Information Extraction for Open Source Intelligence — Open-Source INTeelligence (OSINT) is intelligence based on publicly available resources, such as news sites, blogs, forums, social networks, etc. In OSINT, the Web is the primary source of information, and extracting, structuring and interpreting such information are crucial problems in many application scenarios, like, for instance, security, market intelligence, or statistics. We study how to transform raw information crawled from the Web into actionable data, by coupling traditional information extraction approaches with the use of semantic technologies, which may help to automatize this process and to assign a precise structure and a clear semantic to the extracted data.

Malware Analysis Support Tools — Understanding the behavior of malware requires a semiautomatic approach including complex software tools and human analysts in the loop. However, the huge number of malicious samples developed daily calls for some prioritization mechanism to carefully select the samples that really deserve to be further examined by analysts. This avoids computational resources being overloaded and human analysts saturated. We investigate a malware triage stage where samples are quickly and automatically examined to promptly decide whether they should be immediately dispatched to human analysts or to other specific automatic analysis queues, rather than following the common and slow analysis pipeline.

Privacy Preserving Applications — Private computing provides a clever way to process data without revealing any details about the data itself to the party in charge of processing it. Data protection can be achieved by encrypting the signals and processing them in encrypted form. Possible applications of this approach are virtually endless. Among them, we explore privacy-preserving biometric matching, biomedical signal processing, private sensor fusion in IoT swarms, and private sample analysis for malware identification.

Return Oriented Programming — Code reuse attacks are exploits in which an attacker can execute arbitrary code on a compromised machine without having to inject it in memory, as they achieve the intended behavior by joining fragments of code belonging to a legit installed software component. Return oriented programming (ROP) attacks are the most common form of such attacks. We have been building a collection of ROP exploits of increasing complexity to foster their study in the research community; we also developed a tool for inspecting and analyzing how a ROP attack takes place, which can be sometimes a cumbersome task even for security professionals due to the entanglements of ROP code, and frequently an off-putting job for researchers. We are also exploring how code reuse can be employed in a defensive scenario, for instance to protect intellectual property in the context of code obfuscation and anti-piracy applications.

Swarm Attestation — Remote attestation protocols are widely used to detect device configuration (e.g., software and/or data) compromise in Internet of Things (IoT) scenarios. Unfortunately, the performances of such protocols are unsatisfactory when dealing with thousands of smart devices. Upon the recent concept of non-interactive attestation, we are approaching collective attestation problem by reducing it into a minimum consensus one and the results confirm the suitability of such solution for low-end devices, and highly unstructured networks.

Symbolic execution — In recent years symbolic execution has drawn considerable attention from academic and industrial researchers, with notable applications to, e.g., software testing, program verification, and security. We authored a survey of symbolic execution techniques, reviewing the state of the art in the design, implementation, and open research problems in the area, with particular attention to cybersecurity aspects. We have been researching in memory modeling problems for symbolic executors, proposing a model that can accurately capture pointer dereferencing operations, which are critical for instance in the detection of vulnerabilities (such as use-after-free and heap overflow) and in turn for their exploitation. We also explored how symbolic execution can help reconstruct the protocol used in Remote Access Trojans, which are weapons used by cybercriminals to control infected endpoints.

Visual analytics — Visual Analytics is the science of analytical reasoning facilitated by visual interactive interfaces. In the cyber-security domain it allows the human to manipulate and manage large quantities of data through powerful visual abstrac-

tions, supporting heterogeneous analysis tasks like monitoring, proactive and reactive analysis, what-if analysis and prediction. The support is at different levels, ranging from strategic decision processes down to active cyber-attacks countermeasures. We are actively studying novel visual analytics solutions for cyber-security, focused on supporting proactive analysis of cyber-risk status for complex networks, real-time response to cyber attacks, effective explanation of learning process for malware classifiers, cybersecurity policy assessment and specification through standard frameworks (e.g. NIST cyber-security framework). Solutions regarding improving situational awareness of cyber-security operators under stressful situations and support to digital forensics activities are currently under development.

The cybersecurity group members are also strongly involved in the activities of the Research Center of Cyber Intelligence and Information Security (CIS). CIS does leadership applied research in the context of cyber security, information assurance, critical information infrastructure protection, trend prediction, open-source intelligence, cyber physical systems and smart complex systems. Advanced capabilities in cyber intelligence will be indeed essential in the next years due to the pervasiveness of cloud, social computing and mobility technologies, that lower the control that organizations and governments have over systems, infrastructure and data. CIS aims at designing better information security methodologies, threat profiles and at elaborating defense strategies taking into account the economic and legal impact in a unique framework. Research results are applied to real world contexts such as cyberwarfare, fraud detection, stock market stability, detection of tax evasion, monitoring of mission-critical systems, early warning systems and smart environments.

Projects:

- *ATENA, Advanced Tools to assess and mitigate the criticality of ICT components and their dependencies over Critical Infrastructures* (managed by CRAT) - May 2016, April 2019 - EU MG H2020 Project, F. Delli Priscoli.
- *PROMETEO, Protezione di reti elettriche di potenza da attacchi cyber-fisici mediante strategie di controllo*, progetto di Ateneo, prot. RM11715C7EFAF857, A. Di Giorgio.
- *CyberChallenge.IT 2018* - Industry-funded cybersecurity dissemination project, C. Demetrescu.
- *FILIERASICURA* (managed by CINI) - December 2016, December 2019 - Industrial project with CISCO and Leonardo, L. Querzoni.
- *EURASIA* - October 2016, October 2018 - Italy-Israel joint project, R. Baldoni.

3.3.8 Data Management and Service-Oriented Computing

Research lines:

- Data Integration and Exchange
- Ontology Based Data Management
- Data Warehousing, Data Quality and Data Cleaning
- Process and Workflow Management
- Service Modeling
- Service Synthesis and Composition

Members: Tiziana Catarci, Giuseppe De Giacomo, Domenico Lembo, Maurizio Lenzerini (leader), Francesco Leotta, Andrea Marrella, Massimo Mecella, Fabio Patrizi, Antonella Poggi, Riccardo Rosati.

Post Docs: Lorenzo Lepore, Valerio Santarelli.

PhD Students: Simone Agostinelli, Gianluca Cima, Federico Croce, Lauren S. Ferro, Manuel Namici, Francesco Sapio, Federico Maria Scafoglieri.

Our interest in Data Management dates back to the '80s, when the main research topics addressed by our group were conceptual modeling and schema integration, now evolved into Information Integration and Data Exchange. Information integration is the problem of combining the data residing at different heterogeneous sources, and providing a virtual unified view of these data, called global schema, which can be queried by the users. Data Exchange focuses instead on the problem of materializing the global schema according to the data retrieved from the sources. Ontology-based data management (OBDM) is a promising direction for addressing the above challenges. The key idea of OBDM is to resort to a three-level architecture, constituted by the ontology, the sources, and the mapping between the two, where the ontology is a formal description of the domain of interest, and is the heart of the whole system. With this approach, the integrated view that the system provides to information consumers is not merely a data structure accommodating the various data at the sources, but a semantically rich description of the relevant concepts in the domain of interest, as well as the relationships between such concepts. Other Data Management topics related to Information Integration are also investigated, including View-based Query Processing, Data Warehousing, Data Quality, and Data Cleaning.

Our research interests include several aspects of Service-Oriented Computing, and its relationship with Data Management. Services in our context are autonomous, platform-independent computational elements that can be described, published, discovered, orchestrated and programmed for the purpose of developing distributed interoperable applications. We are particularly interested in service modeling and automatic service composition. In this area, we proposed what in the community is now known as the "Roman

model”, and contributing to one of the first solutions to automated service composition. Since its introduction, the Roman model has been studied by several research groups worldwide, and is one of the key references in the formal approaches to automated service composition. We have also studied Service Synthesis, as well as Process and Workflow Management, with a special focus on principles and techniques for modeling the interaction between processes and data.

Data and Service Integration is considered one of the main challenges that Information Technology (IT) currently faces. It is highly relevant in classical IT applications, such as enterprise information management and data warehousing, as well as in scenarios like scientific computing, e-government, and web data management. Our long-term goal is to lay the foundations of a new generation of information integration and service composition systems, whose main characteristics are

- (i) posing the semantics of the application domain at the center of the scene,
- (ii) combining the management of data with the management of the processes and services using such data in the organization, and
- (iii) shifting the role of the conceptual model from a design-time to a run-time artifact.

In our vision, the functionalities provided by the system include answering queries posed in terms of the conceptual model by suitably accessing the source data, performing updates over the conceptual models by invoking the appropriate updates on the sources, and realizing complex goals expressed by the client by automatically composing available services. The basic idea for realizing this goal is to combine principles, methods and techniques from different areas, namely, Data Management, Service-Oriented Computing, Knowledge Representation and Reasoning, and Formal Methods.

In 2018, members of the research group have been invited to organize various events, and to deliver keynote speeches at various conferences and workshops: Tiziana Catarci is the Editor-in-Chief of the ACM Journal of Data and Information Quality. In 2018 she has been Area chair of IEEE ICDE 2018 and General Chair of AVI 2018. Since 2016 she is member of the prestigious European Academy of Sciences and Arts. Since 2016 she has been included among the “100 Women for Science” project - <http://www.100esperte.it/>. In 2018 she has been included among the “Inspiring-Fifty”, <https://italy.inspiringfifty.org/>, the most influential women in the tech world. In 2018 she has been nominated fellow of the EAI - European Alliance for Innovation. She is the co-EiC of the EAI Transactions on Ambient Systems. She is in the Editorial Board of the WWW Journal and in the Editorial Board of the Journal on Data Semantics.

Domenico Lembo is Vice-presidente of the Steering Committee of the *International Conference on Web Reasoning and Rule Systems* (RR).

Maurizio Lenzerini is Area Editor of Information Systems - An International Journal for the area of Data Modeling and Knowledge Representation and Reasoning Techniques, Area Editor of Logic Journal of the IGPL (Oxford Journal of the Interest Group in Pure and Applied Logic), for the area of Logic for Knowledge Representation and

the Semantic Web, Area Editor of Journal of Applied Logic for the area of Logic for Knowledge Representation and the Semantic Web, in the Editorial Board of the LMCS - Logical Methods in Computer Science, for the areas of Database theory and Logic for knowledge representation, in the Editorial Board of Big Data Research, Elsevier, in the Editorial Board of *Intelligenza Artificiale*, The International Journal of the AI*IA. He was in the Senior Program Committee of the the 27th International Joint Conference on Artificial Intelligence and the 23rd European Conference on Artificial Intelligence, IJCAI-ECAI 2018, in the Program Committee of the Thirty-second AAAI Conference on Artificial Intelligence, AAAI 2018, in the Program Committee of the RuleML+RR: International Joint Conference on Rules and Reasoning, RuleMLRR 2018, in the Program Committee of the XIII National Conference on Statistics, 2018, in the Program Committee of the The First IEEE International Conference on Artificial Intelligence and Knowledge Engineering, AIKE 2018. Since 2005 he is Member of the Sistemi Evoluti di Basi di Dati (SEBD) Steering Committee; He is also Member of the Scientific Advisory Board of BiCi –Bertinoro international Center for Informatics, and Member of the Advisory Board of the European Research Institute in Service Science (ERISS).

Andrea Marrella is Information Director of the ACM International Journal on Data and Information Quality (ACM JDIQ), and Associate Editor (Editorial Board Member) of the International Journal of Information Systems for Crisis Response and Management (IJISCRAM). He has been selected as Expert Reviewer for the grant of Natural Science and Engineering Research Council of Canada - Discovery Grants Program (NSERC).

Massimo Mecella was General Chair of the 14th International Conference on Intelligent Environments, IE 2018.

Finally, Antonella Poggi was Invited Speaker at the 13th Conferenza Nazionale di Statistica.

Projects:

- “Ontology-based data management for health-related quality of life of thyroid cancer patients”. Project funded by Sapienza. The project will end in 26/02/2022, R. Rosati.
- “Sperimentazione e realizzazione prototipale di sistemi tecnologici basati su ontologia per la gestione integrata di banche dati riguardanti i veicoli”. Project funded by ACI Informatica S.p.A. D 447.980 - Rif. CIG 66898173A1. The project will end in 28/07/2019, M. Lenzerini.
- PRE-O-PRE - “PREserving Open data while opening PREserved data”. Research project funded by Sapienza. The project will end in 31/10/2019, A. Poggi.
- MODEUS - “Making Open Data Effectively USable”. SIR research project funded by MIUR, grant n. RBSI14TQHQ. The project will end in 03/2020, A. Poggi.
- “Design and Maintenance of Ontology-Based Data Access Systems”. Research project funded by Sapienza. The project will end in 31/12/2019, D. Lembo.

- Research project funded by MIUR under FFABR (Fondo di Finanziamento per le Attività Base di Ricerca). The project will end in 31/12/2018, D. Lembo.
- “FIRST”. Research project funded by H2020 RISE. The project will end in 31/12/2020. M. Mecella.
- “Fustella 4.0”. Research project funded by Rota Laser Dies S.r.l.. The project will end in 31/12/2019, M. Mecella.
- “EcoDigit”. Project funded by Centro Eccellenza Distretto Beni Culturali Regione Lazio. The project will end in 25/01/2020, M. Mecella.

3.3.9 Distributed Systems

Research lines:

- Secure and robust distributed systems
- Fog Computing
- Theoretical Aspects of DLTs
- Event-based Systems
- Stream processing systems
- Resource Sharing Systems
- Smart Environments
- Distributed Systems Interoperability

Members: Roberto Baldoni (leader), Roberto Beraldi, Silvia Bonomi, Bruno Ciciani, Leonardo Querzoni.

Post Docs: Claudio Ciccotelli, Antonella Del Pozzo.

PhD Students: Giovanni Farina.

The Distributed Systems group has developed, in the last ten years, a solid worldwide reputation in the context of theory and practice of distributed, pervasive and p2p computing, middleware platforms, data processing, and information systems infrastructures. On these topics, the group has created strong relationships with the most influential research groups in the world. In the last ten years the group has developed several theories and practical experiences in several topics including checkpointing, causal and total ordering theory, distributed replication systems, interceptors, group toolkits, and publish subscribe systems.

The distributed systems group has participated and successfully coordinated several important EU projects in the context of e-government, security and dependability of large scale systems, and protection of the financial infrastructure. It has developed remarkable connections with the major Italian ICT industries and Public Administrations for creating innovative solutions and prototypes transferring the latest results from research area into practice. Our activities are centered around the MidLab laboratory and the Research Center of Cyber Intelligence and Information Security (CIS).

MidLab is focussed on research; its primary goal is to support leading-edge research and development on middleware bridging the gap between the latest research results and the current technologies. In particular main MIDLAB targets are the study, the design and analysis of novel middleware platforms able to increase the robustness of information exchanging with respect to reliability, consistency, predictability and security. In the last

few years MidLab members have also started to pursue new research trends in the area of high-performance stream processing systems and graph-based computations.

The Distributed Systems group is also strongly involved in the activities of the Research Center of Cyber Intelligence and Information Security (CIS). CIS does leadership research in the context of cyber security, information assurance, critical information infrastructure protection, trend prediction, malware analysis, open-source intelligence, cyber physical systems and smart complex systems. Advanced capabilities in cyber intelligence will be indeed essential in the next years due to the pervasiveness of cloud, social computing and mobility technologies, that lower the control that organizations and governments have over systems, infrastructure and data. CIS aims at designing better information security methodologies, threat profiles and at elaborating defense strategies taking into account the economic and legal impact in a unique framework. Research results are applied to real world contexts such as cyberwarfare, fraud detection, stock market stability, detection of tax evasion, monitoring of mission-critical systems, early warning systems and smart environments.

Projects:

- *FILIERASICURA* - December 2016, December 2019 - Industrial project with CISCO and Leonardo.
- *EURASIA* - October 2016, October 2018 - Italy-Israel joint project.

3.3.10 High Performance and Dependable Computing Systems

Research lines:

- Parallel and Distributed Computing Platforms
- Operating Systems
- High Performance Computing
- Multi-core Programming
- Multi-tier Architectures
- Transactional Systems
- Virtualization and Cloud Computing
- Non-blocking/Wait-Free Algorithms
- Software Instrumentation and Compiling Techniques
- Software Reversibility on Non-Reversible Systems
- Performability Models
- Heterogeneous Computing

Members: Bruno Ciciani (leader)

Post Docs: Pierangelo Di Sanzo, Alessandro Pellegrini.

PhD Students: Stefano Carnà, Davide Cingolani, Stefano Conoci, Simone Economo, Mauro Ianni, Romolo Marotta, Emiliano Silvestri.

The High Performance and Dependable Computing Systems research group is focused on differentiated aspects of computing and service-oriented applications and platforms, spanning from theory to modeling, design and implementation. Significant results have been achieved in:

- the definition of frameworks and protocols for dependability in large scale infrastructures, with particular attention to application contexts entailing manipulation of data within (atomic) distributed transactions;
- the design and implementation of high-performance computing platforms, with particular interest to discrete event simulation platforms conforming to both proprietary and standardized protocol stacks;
- the design and development of innovative operating system services oriented to support-high performance computing applications and data intensive ones;

- binary instrumentation to transparently inject non-functional, rather performance/reliability-oriented capabilities, within general applications;
- the design of techniques for improving energy-efficiency of applications deployed on massively-parallel machines;
- the design and/or exploitation of transactional memory paradigms, either software- or hardware-based;
- the design and implementation of transparent middleware-level software to enable software reversibility on top of non-reversible hardware, as a building block to optimize execution of data-intensive applications and/or enable post-mortem reversible debugging;
- the definition and validation of accurate performance and dependability models for components/sub-systems forming the core of the aforementioned computing environments.

The vision characterizing the research of this group is based on a strong synergy between theoretical studies and design/development techniques aimed at bridging theory and practice by accurately assessing the viability of research results in environments and application contexts based on current technologies, and in those that can be foreseen via emerging technological trends. Up to now, various open source packages have been released as a concrete indication of the effectiveness of the aforementioned approach. Some of the publicly-released packages have been already adopted by other (foreign) research centers/industrial parties.

Several research challenges can be easily envisaged along the paths of Quality-of-Service (QoS) oriented design of systems, as well as the design of autonomic systems embedding self-properties aimed at ensuring/guaranteeing/achieving pre-determined performance and/or dependability levels. The container hosting and framing these challenges will include both traditional system organizations and innovative computing environments relying on systematic use of infrastructure virtualization approaches, such as cloud computing. Further, we target innovative programming models and paradigms, such as sequential/concurrent programming based (a) on transparent and automatic techniques supporting reverse computing schemes as a mean for maintaining causal consistency as well as guaranteeing fault tolerance and security, and to enable reversible/post-mortem debugging (b) transparent injection via instrumentation of non-functional logic within generic applications so as to guarantee the possibility to drive the execution of these applications while optimizing resource/energy usage as well as performance.

Projects:

- *SATURN: Spatio-Temporal Cloud Store for Big-Data Applications* - 2015–2018.
- *URBEM: URBan Environment Management* - 2018–2019.

3.3.11 Human-Computer Interaction

Research lines:

- User Interfaces
- Usability Engineering and Accessibility
- Information Visualization and Visual Analytics
- Automated Personalization and Adaptation in Web-based Learning
- Web-based Social Collaborative Learning
- Game-based Technology-Enhanced Learning

Members: Tiziana Catarci (leader), Massimo Mecella, Giuseppe Santucci, Marco Temperini.

Post Docs: Marco Angelini, Francesco Leotta, Andrea Marrella.

PhD Students: Graziano Blasilli, Lauren Ferro, Simone Lenti, Francesco Sapio, Mahmoud Sharf.

Human-Computer interaction (HCI) is the study of the interaction between people (users) and computers. Such an interaction traditionally occurs at the user interface, but its effectiveness is strongly related with the design of the entire interactive system, referring in particular to the way in which it supports the user in achieving her/his goals and executing her/his tasks. Indeed, an important facet of HCI is the securing of the interactive system usability. The research group started working on HCI topics during the late '80s, while developing a visual interface for databases. This pioneering work can be regarded as one of the first and most significant examples of deep analysis and formalization of the interaction between the user and the database, which takes into consideration both usability issues and language related aspects.

Following these lines, the group developed another relevant research topic, namely the definition of adequate visual representations of the databases, in terms of both schema and instances. Note that using a consistent visual representation to depict the information of interest is crucial in order for the user to correctly grasp the database information content. Related with visual representation is information visualization, i.e. the use of computer-based, visual, interactive representations of information with the purpose of making sense out of data, acquire knowledge, discover new information, and effectively present the result.

In the last years we focused on clutter reduction for information visualization analyzing the visual issues associated with the use of density maps focusing on the correct assignment of visual variable values to a data domain, taking into account its frequency distributions. Other HCI topics are also investigated, including the study of specific

usability, accessibility, and adaptivity methodological aspects, the interaction with different realms, e.g. digital libraries, cultural artifacts, mobile and ubiquitous systems, technology-enhanced learning environments.

Designing interactive systems that could be effectively, efficiently and with satisfaction used by people exhibiting different characteristics, needs, preferences and abilities is getting more and more important in Information Technology research and development, as it is clearly demonstrated by the growing importance of the user role in research projects as well as in public administration developments, by the introduction in several Laws of precise usability and accessibility requirements for governmental information systems, by the continuous increase of funding for HCI-related research at EU and international level.

We have been among the pioneers of the research in this field in Europe, in particular in the effort of giving formal basis to the definition of interaction while considering human-related, perceptual aspects. We are still continuing in this direction, in particular by working on a machine-interpretable and machine-learnable model of user task that will be the basis for a novel task-oriented interaction model, to be tested in personal information environments. Furthermore, innovative interaction styles, e.g. brain-computer interfaces, ubiquitous and sensor-based environments, extreme visualizations, are under study, as well as novel design methodologies, advancing traditional user-centered design both with the injection of agile concepts and directly encompassing accessibility aspects.

Scientific roles:

- Tiziana Catarci is Editor in Chief of EAI Transactions on Ambient Systems.
- Tiziana Catarci since 2016 she is member of the prestigious European Academy of Sciences and Arts.
- Tiziana Catarci since 2016 she has been included among the “100 Women for Science” project - <http://www.100esperte.it/>.
- Tiziana Catarci in 2018 has been included among the “InspiringFifty”, <https://italy.inspiringfifty.org/>, the most influential women in the tech world.
- Tiziana Catarci in 2018 she has been nominated fellow of the EAI – European Alliance for Innovation.
- Giuseppe Santucci is in the Steering Committee of IEEE Conference on Visual Analytics Science and Technology - VAST.
- Giuseppe Santucci is in the Steering Committee of EG/VGTC Conference on Visualization - EUROVIS.
- Giuseppe Santucci is in the Program Committee of EG/VGTC Conference on Visualization - EUROVIS.
- Giuseppe Santucci is in the Program Committee of IEEE Conference on Visual Analytics Science and Technology - VAST.

- Giuseppe Santucci is in the Steering Committee of ACM International Workshop BEYond time and errors: novel evaLUation methods for Information Visualization BELIV.
- Giuseppe Santucci is Workshop & Tutorial Chair in the conference Advanced Visual Interfaces AVI.
- Massimo Mecella is general chair of International conference of Advanced Visual Interfaces (AVI) 2018.
- Marco Temperini is Associate editor in the journal IJDET (Int. Journal on Distance Education Technology, <https://www.igi-global.com/journal/international-journal-distance-education-technologies/1078>).
- Marco Temperini is member of the Steering Committee of the workshop IEE-TEL (Int. workshop on Interactive Environments and Emerging Technologies for eLearning, <https://sites.google.com/view/ieetel2019>).
- Andrea Marrella is the Poster & Demo Chair of 14th International Conference on Advanced Visual Interfaces (AVI 2018).
- Francesco Leotta is Poster & Demo Chair for Intelligent Environments 2018.
- Marco Angelini was co-chair of ITA.WA, 1st Italian workshop on Advanced Visualizations and Visual Analytics, co-located at AVI 2018.

Projects:

- *NEPTIS* - January 2015 – March 2018 – Italian PON (PON03PE_00214).
- *IT-SHIRT* - 2018 – 2020 – Sapienza project.
- *METRICS* - 2018 – Sapienza project .
- *9 Conversations: Network building for self-employment of refugees* - 2018 —2020 Erasmus+ Programme, Key Action 2.
- *NOTAE* ERC-2017-ADG project NOTAE (N^O786572).

3.4 Management Engineering

3.4.1 Industrial Organization and Management

Research lines:

- Competition, Regulation and Industrial Policy
- Mechanism Design and Auctions
- Economics and Management of Education and Research
- Efficiency and Productivity Analysis
- Management Control Systems
- Operations Management
- Industry Studies: Media, Telecommunications, Transportation, Utilities, and Services

Members: Alessandro Annarelli, Alessandro Avenali, Giuseppe Catalano, Tiziana D'Alfonso, Rosa Maria Dangelico, Cinzia Daraio, Luca Fraccascia, Domenico Laise, Claudio Leporelli, Riccardo Marzano, Giorgio Matteucci, Alberto Nastasi, Fabio Nonino, Pierfrancesco Reverberi.

Post Docs: Mirko Giagnorio.

PhD Students: Martina Gregori, Thyago Nepomuceno, Giulia Palombi, Alessandro Pompei, Luigi Scuncio.

The research activity of the group, that includes general issues in industrial economics, public policy and management, is performed by three research groups: *Industrial Organization, Management and Efficiency, Effectiveness and Impact Analysis of Education and Research: methods and applications*.

The *Industrial Organization* research group focuses on the following topics:

- *Competition, regulation, incentives to investments and industrial policy in network industries* (with a focus on telecommunications, air transport, rail transport, local public transport and utilities), in the media industry and in the pharmaceutical sector. For this purpose, the group develops and makes use of game theory, cost proxy models, econometrics, and economic models for the evaluation of investments.
- *Productivity and efficiency analysis*, with a focus on the development of parametric and non-parametric methods which can be applied to different fields in Economics and Management.

- *Economics and management of education and research activities*, with a focus on the evaluation of performance, accreditation and funding of education institutions located in the main European countries. For this purpose, the group develops and makes use of efficiency analysis and econometrics.
- *Mechanism design*, with a focus on the analysis and the development of auction procedures for the efficient allocation of scarce resources, characterized by complementarities or substitutability effects, and on the innovation of procurement systems. For this purpose, the group develops and makes use of agent-based simulation models, game theory and mathematical programming.

The *Management* research group focuses on the following topics:

- *Management control systems*, with a focus on the analysis of organizational procedures and the development of a system of indicators. For this purpose, the group develops and makes use of the multi-criteria methodology applied to managerial decision making problems.
- *Operations management*, with a focus on the performance analysis of innovative product/services development models, production system and supply-chains in complex organizations.
- *Green Management and Corporate Sustainability*, with a focus on the integration of environmental sustainability into corporate strategies and the analysis of the success factors of the green product development process.

The group *Efficiency, Effectiveness and Impact Analysis of Education and Research: methods and applications* performs both theoretical and empirical analysis aimed to the formulation of recommendations for public policies. In particular, this research group has focused on the following topics:

- *Efficiency, effectiveness of scientific research and educational system*, with particular reference to: the evaluation of higher education, scientific research, technological innovation and their financing; the development of new bibliometric approaches and indicators to assess the scientific competitiveness at country, regional and local level; the analysis of the market structure of higher education in Italy and in the European countries; the analysis of public funding to the university system in Italy and other major European countries; the development of public policies in education and scientific research;
- *Evaluation of the administrative activities of the university*, with particular reference to: e-procurement policies and services to support students, funding systems for students and interventions for student aid (loans and bonus); effectiveness of scholarships; managerial tools for the management of universities and public research institutions; management control systems and strategic planning of universities; management of students' accommodations.

Finally, the group has established scientific collaborations with national and international public institutions and universities; it is part of the European Network of Indicators Designers (ENID) and of the observatory on Local Public Transport of the Ministry of Infrastructures and Transport (MIT), has implemented and implements different collaborations with the National Agency for University and Scientific Research Evaluation (ANVUR), the Ministry of Education, Universities, and Research (MIUR), the Ministry of infrastructures and Transport and the European Commission on the themes of the evaluation of the impact of public policies for higher education and scientific research and on the themes of the standard cost of local public transport.

Projects:

- 2015-2018: H2020, BONVOYAGE - Intermodal mobility solutions, interfaces and applications for people and goods, supported by an innovative communication network, F. Delli Priscoli.
- 2017-2019: H2020, Implementation and Further Development of the European Tertiary Education Register ETER III, Contract No. 934533-2017 A08-CH, C. Daraio.
- 2017-2019: Modelling and Mapping the Dynamics of Knowledge. A Co-Creation Indicators Factory Design, Progetti H2020 Sapienza 2017 Awards, No. PH11715C8239C105, C. Daraio.
- 2017-2018: Sapienza Research Awards no. (C26N15TJLN) Methods and procedures for the determination of standard costs in the local public bus transport sector, T. D'Alfonso.
- 2017-2019: Sapienza Research Awards, Green innovation in family firms: drivers, characteristics, and success factors, R. M. Dangelico.
- 2017-2019: Sapienza Research Awards, Methods and procedures for the allocation of national public resources in the Italian local public transport sector, T. D'Alfonso.
- 2017-2020: PRIN, Prot. 2015RJARX7 Comparing Governance Regime Changes in Higher Education: systemic performances, national policy dynamics, and institutional responses. A multidisciplinary and mixed methods analysis, C. Daraio.
- Research infrastructures for the assessment of science, technology and innovation policy (RISIS), Grant agreement No. 313082 project of the EU FP7 Research Program, C. Daraio.
- 2018-2021: Sapienza Research Awards, Strategic formation and welfare effects of airline-high speed rail integration in hub-and-spoke networks, T. D'Alfonso.

3.5 Operations Research

3.5.1 Combinatorial Optimization

Research Lines:

- Polyhedral Combinatorics
- Graph theory and Optimization
- Data Mining and Classification
- Portfolio Optimization
- Telecommunication Network Design
- Scheduling and Job-shop Scheduling
- Computational Biology and Bioinformatics
- Satisfiability in Propositional Logic
- Information Reconstruction
- Robust Optimization

Members: Renato Bruni, Antonio Sassano (leader).

Combinatorial Optimization searches for an optimal set of objects into a finite (but large) collection of sets. Graph Theory, Integer Programming and Polyhedral Combinatorics are the key methodological tools in this area.

The activity of the Combinatorial Optimization Group at DIAG dates back to the early '90s and has been focused both on the theoretical properties of combinatorial structures and the use of sophisticated algorithmic tools to solve real-life problems. In particular, major research has been carried out on the following subjects: polyhedral properties of set covering, stable set and p -median problems; perfect graph theory, exact and heuristic algorithms for stable set and set covering; algorithms for coloring and frequency assignment problems; decomposition algorithms and reformulations for wireless network design problem; fixed network design and survival network design; algorithms for job-shop scheduling and railway traffic management; algorithms for satisfiability of logic formulae, algorithms for information reconstruction in large datasets, algorithms for classification based on propositional logic, algorithms for inconsistency selections.

The group is currently cooperating with the University of Maastricht, University of Oslo, Università di Roma Tor Vergata, Università dell'Aquila, Università di Lecce, Politecnico di Milano, Università del Sannio, Istituto Nazionale di Statistica (Istat), Texas Tech University, ZIB Berlin. The group has been involved in a large number of national and international projects. In the last 10 years the group has developed methods and algorithms aimed at the *optimal design of broadcasting networks*. The scientific leadership gained in this field has motivated a stable cooperation with the *Italian Authority for*

Telecommunication and the decisive contribution of the group to the design of the national (analog and digital) TV and radio plans.

The current key members of the group have published more than 100 journal papers, several book chapters, and two books. Moreover they are or have been editors of some of the main journals in the field of Operations Research and Optimization. Recently the group received a prestigious international award from the Association of European Operational Research Societies (EPA 2009). In addition to further development of on-going research project, our future activities involve the study of optimization algorithms to rescue or prevent financial crises and for portfolio management; algorithms for weighted matching and stable set problems; polyhedral properties of the stable set polyhedron and of interval and staircase matrices; optimization techniques for classification problems in machine learning; purely combinatorial approaches to wireless network design; railway traffic control and optimization on single-track networks.

Projects:

- Tecniche di Ottimizzazione Combinatoria per la risoluzione di problemi di Data Mining in campo Economico-Gestionale, progetto di ricerca Sapienza, Dec. 2016 - May 2018, R. Bruni.
- APICE - Algoritmi per la Pianificazione Integrata e Controllo di reti wireless Eterogenee, progetto MIUR n. 2878, R. Bruni.

3.5.2 Continuous Optimization

Research lines:

- Nonlinear Optimization
- Derivative Free Methods
- Global Optimization
- Semidefinite Programming
- Variational Inequalities
- Bilevel Optimization
- Mixed Integer Nonlinear Programming
- Big Data Optimization
- Simulation-based optimization
- Parallel and distributed optimization methods
- Game Engineering
- Neural Networks and Support Vector Machines
- Engineering Design Optimization
- Resource allocation in communication networks

Members: Alberto De Santis, Marianna De Santis, Gianni Di Pillo (leader ad honorem, emeritus), Francisco Facchinei, Luigi Grippo (retired), Stefano Lucidi (leader), Laura Palagi, Massimo Roma, Simone Sagratella.

PhD Students: Marco Boresta, Tommaso Colombo, Annalivia Croella, Danny D'Agostino, Tommaso Giovannelli, Giorgio Grani, Francesco Romito, Ruggiero Seccia, Edoardo Maria Tronci.

Research in continuous optimization has been active at DIAG since its foundation. Early research was essentially devoted to the theory of exact penalization and to the development of algorithms for the solution of constrained nonlinear programming problems through unconstrained techniques. Significant early contributions were also given in the field of unconstrained optimization, with the introduction of non monotone line searches, non monotone globalization strategies and convergent derivative-free line search techniques. The Continuous Optimization group later expanded into an active and highly valued optimization research team with a wide range of interests. The following areas are object of current research.

- Exact penalty and augmented Lagrangian methods, still constituting the founding block of many optimization methods and a springboard for many of the studies of the group.
- Non-monotone methods and decomposition techniques for the solution of difficult large-scale nonlinear optimization problems and nonlinear equations.
- Preconditioning Newton-Krylov and Nonlinear Conjugate Gradient methods in nonconvex large scale optimization, which is an important tool for efficiently solving large difficult problems.
- Derivative-free algorithms, of special interest in many engineering applications where even the calculation of function values is problematic and very time-consuming.
- Global optimization, which is an essential tool for solving problems where local non-global solutions may be meaningless.
- Semidefinite programming, that plays an essential role in the development of efficient algorithms for solving relaxations of non-convex and integer problems.
- Finite dimensional variational inequalities and complementarity problems, which often arise in modelling a wide array of real-world problems where competition is involved.
- Generalized Nash equilibrium problems, which are emerging as a winning way of looking at several classical and non-classical engineering problems.
- Training methods for neural networks and support vector machines, for constructing surrogate models of complex systems from sparse data through learning techniques.
- Mixed Integer Nonlinear Programming (MINLP) problems that combine combinatorial aspects with nonlinearities.

The Continuous Optimization group interacts intensively with many other research groups, both in the academic and industrial world, in an ongoing cross-fertilization process. This process led to several innovative applications in such different fields as:

- Design of electro-mechanic devices.
- Development of electromagnetic diagnostic equipments.
- Power allocation in TLC.
- Shape optimization in ship design.
- Multiobjective optimization of nanoelectronic devices.
- Optimization of ship itineraries for a cruise fleet.

- Sales forecasting in retail stores.

Moreover, as a spin-off of the activity carried out in applied optimization, the company ACTOR (Analytics, Control Technologies and Operations Research) has been founded. ACTOR is participated by Sapienza University, by researchers of the Department and by the private company ACT Solutions. The main aim of ACTOR is to develop and commercialize advanced optimization models and methods to be employed in the production and management of goods and services.

3.6 Systems and Control Engineering

3.6.1 Networked Systems

Research lines:

- Control of Networks, Control over Networks
- Control under Communication Constraints
- Modeling, Filtering and Optimal Control of Communication Networks
- Remote Control

Members: Francesco Delli Priscoli (co-leader), Alessandro Di Giorgio, Alberto Isidori (emeritus), Antonio Pietrabissa (co-leader).

Post Docs: Silvia Canale, Federico Cimorelli, Andrea Fiaschetti, Francesco Liberati, Martina Panfili, Lorenzo Ricciardi Celsi, Vincenzo Suraci.

PhD Students: Roberto Germaná, Alessandro Giuseppi, Federico Lisi, Antonio Ornatelli, Andrea Tortorelli.

The networked systems area has developed, in the last 18 years, thanks to the successful participation in 38 major advanced research projects mainly financed by the European Union (EU), carried on together with major European ICT players. The networked systems area supports a Future Internet vision (in particular, the group participated to the large FI-WARE EU project just concerning the Future Internet technology foundation) foreseeing a technology independent distributed framework including coordinated advanced control algorithms (utilizing methodologies such as reinforcement learning for multi-agent systems, data mining, game theory, bounded optimal control, predictive control and robust control). These algorithms, on the basis of homogeneous integrated metadata (derived from properly selected heterogeneous information related to the present network and user status, converted in metadata and aggregated in a context-aware fashion), take consistent decisions (which are eventually actuated in the networks) concerning the management of network resources and of network contents/services, aiming at maximizing resource exploitation, while satisfying users in terms of Quality of Experience expectations (related to Quality of Service, security, mobility... requirements). To deal with the above-mentioned vision, the networked systems area deals with the following key enablers: model-free learning, multi-agent systems with minimum coordination, cross-layering/cross-network optimization, context awareness, data fusion, decision support systems. In the framework of the in-progress projects, the above-mentioned vision has been applied in the following areas: home network speed enhancement up to Gbps, optimization of hybrid ad hoc and satellite networks, resource management for telecommunication and energy distribution networks (smart grids), demand side management for planning electric utilities, smart grids for supporting fully electrical vehicles, content management for peer-to-peer television, protection of critical

infrastructures, total airport security, embedded system security/privacy/dependability, remote diagnosis and management of cardiovascular diseases, intermodal mobility solutions for people and goods, space assets for demining assistance, wireless cognitive sensor networks.

Projects:

- *5G-ALLSTAR, 5G AgiLe and fLexible integration of SaTellite And cellulaR* (managed by CRAT) - July 2018, June 2021 - EUK2018 H2020 Project, F. Delli Priscoli and A. Pietrabissa.
- *ATENA, Advanced Tools to assEss and mitigate the criticality of ICT compoNents and their dependencies over Critical InfrAstructures* (managed by CRAT) - May 2016, April 2019 - EU MG H2020 Project, F. Delli Priscoli.
- *Bonvoyage, From Bilbao to Oslo, intermodal mobility solutions and interfaces for people and goods, supported by an innovative communication network* (managed by CRAT) - May 2015, April 2018 - EU DS H2020 Project, F. Delli Priscoli.
- *PROMETEO, Protezione di reti elettriche di potenza da attacchi cyber-fisici mediante strategie di controllo*, progetto di Ateneo, prot. RM11715C7EFAF857, A. Di Giorgio.

3.6.2 Nonlinear Systems and Control

Research lines:

- Robust Control
- Stability and Stabilization
- Tracking and Regulation
- Optimal Control and Stochastic Systems
- Hybrid Systems
- Discrete-time and Sampled Data Systems
- Data Acquisition and Sensor Networks
- Control Applications

Members: Stefano Battilotti, Luca Benvenuti, Claudia Califano, Paolo Di Giamberardino, Daniela Iacoviello, Alberto Isidori (leader ad honorem, emeritus), Salvatore Monaco (leader).

Post Docs: Mattia Mattioni.

PhD Students: Massimiliano D'Angelo, Mohamed Elobaid, Alessio Moreschini.

Research on nonlinear systems and control at the University Sapienza has been active since the early 70s and, historically, has played a major role worldwide. The geometric approach to nonlinear feedback design, developed in the late 70s, marked the beginning of a new area of research which, in the subsequent decades, has profoundly influenced the development of the entire field. The concept of (nonlinear) feedback equivalence and of zero dynamics, their properties and implications in feedback design, are perhaps the most frequently used concepts in feedback stabilization. The geometric approach also plays a fundamental role in the analysis of systems evolving on Lie groups, with numerous applications to the control of spacecrafts and mobile robots. The natural evolution of the geometric approach to analysis and design of nonlinear systems led to a refinement of concepts underlying the design of nonlinear controllers to the purpose of shaping the steady-state behavior of a system. Currently, this line of research is pursued with the study of problems arising in the regulation of systems possessing unstable zero dynamics and in the development of methods for robust stabilization via measurement feedback. A general framework for robust stabilization reposes of the concept of filtered Lyapunov functions. Tools for the design of composite filtered Lyapunov functions have been developed. Robust and nonlinear control techniques have proven useful to achieve control objectives in the case of restricted information structure, e.g. measurements taking values only in a finite set and/or feedback delivered to the actuators erratically. A major challenge in the research on control with limited information is the design of controllers

which are distributed over a network. In this case, the controllers cooperate to achieve a common goal but have access only to limited information provided by their neighbors. The notion of incremental generalized homogeneity has been recently introduced in the design of nonlinear stabilizing controllers. Stabilization of nonlinear systems with control and measurement delays. Global state estimators for systems with delays. State estimators and optimal control for noisy systems with non-Gaussian noise and packet loss. Stochastic delay identification. Analysis and design of real control systems integrating devices and computational procedures in a digital context involves ad-hoc methods. Nonlinear discrete-time and sampled data systems are the subjects of an investigation developed at La Sapienza from the early 80s, in a still active cooperation with the Laboratoire des Signaux et Systèmes of the French CNRS. The research activity has been focused on solving nonlinear control problems in discrete-time and on finding digital solutions to continuous-time control systems. One of the major outcome of the investigation has been the settlement of an original approach, mixed by algebraic and geometric concepts, used either to prove the existence of solutions in discrete-time or to compute approximated solutions in the digital context. Two aspects are at the bases of the more recent developments: a new representation of discrete-time dynamics, which provides a natural framework for comparing results from the continuous-time and discrete-time contexts, the concept of exact sampled model under feedback, which can be used to design piecewise continuous controllers in a direct digital context. From the solution to feedback linearization, stabilization, regulation, observer theory, new research lines are in the direction of Lyapunov and passivity based design, inverse optimal control and time delayed systems in discrete-time and under sampling. Particular attention is devoted to the settlement of executable algorithms for computing the proposed solutions. Possible improvements in optimal control problems by means of piecewise continuous cost functions are also under investigation as a new research line in the framework of nonlinear Hamiltonian dynamics and switching control methods. This kind of approach brings to significant improvements when dealing with limited resources or under a high level decision process on the cost of the action or on the priority of the intervention. Measurements devices, algorithms, data handling and transmission represent critical aspects in any distributed control problem. The number of devices, their location, the energy consumption, the data-communication links, the distributed data handling, multi-consensus, load balancing, and quality of experience evaluation and control are nowadays classical problems in this context. New issues deal with dynamic sensor networks, where mobile platforms are assimilated to intelligent devices, in which motion planning and control problems pose additional requirements and make harder the solution of the task. The full problem formulation as a high dimensional nonlinear dynamics is a challenging interdisciplinary area of research towards easier and cheaper solutions to problems like surveillance, monitoring, decentralized and distributed control. Problems under investigation in this field concern sensor and actuator devices, computation algorithms, local and global coordinated control, network communication protocols, data acquisition and fusion. Prof. Monaco is member of the Conseil exécutif and of the Conseil stratégique of the Università Italo Francese and coordinator of the double degree in collaboration with the *Stic& A Network of French Universities*.

The applicative aspects of the research activities are carried out at the Systems and Control Laboratory, founded in 1995.

Projects:

- *Multilayer dynamical modeling, analysis and control of epidemics over networks*, progetto di Ateneo, D. Iacoviello.
- *Controllo di sistemi in rete: problemi collegati alle caratteristiche del grafo e al campionamento dei segnali*, progetto di Ateneo.
- *Modellizzazione e controllo del sistema glicemia-insulinemia in pazienti con diabete di tipo I*, progetto di Ateneo, C. Califano.
- *Sistemi complessi in rete in presenza di ritardi*, Progetto C4-367 Bando Vinci 2018 dell'Università italo-francese UIF/UFI

3.6.3 Robotics

Research lines:

- Robot Modeling, Planning, and Control
- Vision-based Control
- Sensor-based Planning and Exploration
- Physical Human-Robot Interaction
- Mobile Robots and UAVs
- Humanoid Robots
- Networked Robots

Members: Alessandro De Luca (leader), Leonardo Lanari, Giuseppe Oriolo, Marilena Vendittelli.

Post Docs: Massimo Cefalo, Marco Cognetti, Claudio Gaz, Emanuele Magrini, Valerio Modugno.

PhD Students: Khaled Al Khudir, Barbara Barros Carlos, Daniele De Simone, Paolo Ferrari, Marco Ferro, Maram Khatib, Nicola Scianca, Spyridon Tarantos, Giulio Turrisi.

The Robotics group at DIAG, and the associated DIAG Robotics Lab, were established in the late 1980s with a commitment to develop innovative planning and control methods for industrial and service robots.

The main research topics are: nonlinear control of robots; control of manipulators with flexible elements (in particular, with Variable Stiffness Actuation); hybrid force/velocity and impedance control of manipulators interacting with the environment; optimization schemes in kinematically redundant robots; motion planning for high-dimensional systems; motion planning and control of wheeled mobile robots and other nonholonomic mechanical systems; control-based motion planning for mobile manipulators; motion planning and control of locomotion in humanoid robots; stabilization of underactuated robots; control of locomotion platforms for VR immersion; sensor-based navigation and exploration in unknown environments; image-based visual servoing; control and visual servoing for unmanned aerial vehicles (UAV); multi-robot coordination and mutual localization; unsupervised continuous calibration of mobile robots; actuator/sensor fault detection and isolation in robots; safe control of physical human-robot collaboration; sensory supervision of human-robot interaction.

Most of our research activities undergo experimental validation in the DIAG Robotics Lab. The current equipments consist of three articulated manipulators (a 6R Universal Robots UR10, a 7R lightweight KUKA LBR4+ with FastResearchInterface, and a 6R KUKA KR5 industrial robot), two haptic interfaces with 3D force feedback (Geomagic

Touch), an underactuated system (Pendubot by Quanser), and several mobile robots, including wheeled (a MagellanPro by iRobot, a team of five Khepera III by K-Team), legged (3 NAO humanoid robots by Aldebaran), and flying (a Hummingbird and a Pelican quadrotor UAVs by AscTec) platforms. These robots are equipped with sensing devices of various complexity, going from ultrasonic/laser range finders to cameras, and stereo vision systems. We have multiple RGB-D sensors, two 6D F/T sensors (Mini45 by ATI), and a HMD (Oculus Rift). We also have a sensorized platform (Cyberith Virtualizer) for locomotion and VR immersion. In the past, we have designed and built a two-link flexible manipulator (FlexArm) and a differentially-driven wheeled mobile robot (SuperMARIO).

Projects:

- *COMANOID, Multi-Contact Collaborative Humanoids in Aircraft Manufacturing* - January 2015–December 2018 (RIA H2020-ICT-2014-1, 645097), G. Oriolo.
- *SYMPLEXITY, Symbiotic Human-Robot Solutions for Complex Surface Finishing Operations* - January 2015–December 2018 (IA H2020-FoF-2014, 637080), A. De Luca.

4 Publications

Biomedical Engineering

Bioengineering and Bioinformatics

Journal Papers

- Ciaramidaro, A., J. Toppi, C. Casper, C. Freitag, M. Siniatchkin, and L. Astolfi. "Multiple-Brain Connectivity During Third Party Punishment: An EEG Hyperscanning Study". In: *Scientific Reports* (2018). DOI: 10.1038/s41598-018-24416-w.
- Farina, L. and P. Paci. "A Feature-Based Integrated Scoring Scheme for Cell Cycle-Regulated Genes Prioritization". In: *Journal of Theoretical Biology* (2018). DOI: 10.1016/j.jtbi.2018.09.025.
- Fiscon, G., F. Conte, L. Farina, and P. Paci. "Network-Based Approaches to Explore Complex Biological Systems Towards Network Medicine". In: *Genes* (2018). DOI: 10.3390/genes9090437.
- Pichiorri, F., M. Petti, S. Caschera, L. Astolfi, F. Cincotti, and D. Mattia. "An EEG Index of Sensorimotor Interhemispheric Coupling After Unilateral Stroke: Clinical and Neurophysiological Study". In: *European Journal of Neuroscience* (2018). DOI: 10.1111/ejn.13797.
- Toppi, J., L. Astolfi, M. Riseti, A. Anzolin, S. Kober, G. Wood, and D. Mattia. "Different Topological Properties of EEG-Derived Networks Describe Working Memory Phases as Revealed by Graph Theoretical Analysis". In: *Frontiers in Human Neuroscience* (2018). DOI: 10.3389/fnhum.2017.00637.

Conference Proceedings

- Antonacci, Y., J. Toppi, A. Pietrabissa, F. Cincotti, D. Mattia, and L. Astolfi. "How Does Multicollinearity Affect Brain Connectivity? A Simulation Study Based on Penalized Regression Techniques". In: *Atti del VI Congresso Nazionale del GNB, Milano, 25-27 Giugno, 2018*. 2018.
- Antonacci, Y., J. Toppi, A. Pietrabissa, D. Mattia, and L. Astolfi. "Toward Estimation of Brain Connectivity as New Feature for BCI Estimation Application". In: *Proceedings of the Seventh International BCI Meeting, Asilomar, USA, 21-25 May 2018*. 2018.
- Anzolin, A., P. Presti, F. V. D. Steen, J. Toppi, L. Astolfi, S. Haufe, and D. Marinazzo. "Quantifying Mixing in Reconstructed Brain Sources". In: *Atti del VI Congresso Nazionale del GNB, Milano, 25-27 Giugno, 2018*. 2018.
- Colamarino, E., F. Pichiorri, D. Mattia, and F. Cincotti. "Semiautomatic Physiologically-Driven Feature Selection Improves the Usability of a Brain Computer Interface System in Post-Stroke Motor Rehabilitation". In: *Proceedings of the Seventh International BCI Meeting, Asilomar, USA, 21-25 May 2018*. 2018, pp. 96–97.
- Falcone, R., P. Paci, A. Verrienti, F. Conte, M. Sponziello, G. Fiscon, V. Pecce, F. Rosignolo, G. Grani, L. Lamartina, V. Ramundo, C. Durante, L. Farina, and S. Filetti. "Prediction of Response to Vemurafenib in BRAF V600E Mutant Cancers Based on a Network Approach". In: *Proceedings of the European Society for Medical Oncology (ESMO) Congress, Munich, Germany, October 19-23, 2018*. 2018.

- Petti, M., F. Pichiorri, F. Cincotti, D. Mattia, and L. Astolfi. "Motifs Analysis-Based Indices to Discover Brain Network Architecture". In: *Atti del VI Congresso Nazionale del GNB, Milano, 25-27 Giugno, 2018*. 2018.
- Pichiorri, F., E. Colamarino, F. Cincotti, and D. Mattia. "Brain-Computer Interface Technology for Upper Limb Rehabilitation After Stroke: A Translational Effort". In: *Abstracts of the 4th Congress of the European Academy of Neurology*. Vol. 25. European Journal of Neurology. 2018, pp. 50–50. DOI: 10.1111/ene.13698.
- Puxeddu, M. G., M. Petti, F. Pichiorri, F. Cincotti, D. Mattia, and L. Astolfi. "Analysis of Multilayer Clustering Algorithms for the Application to Brain Functional Connectivity". In: *Atti del VI Congresso Nazionale del GNB, Milano, 25-27 Giugno, 2018*. 2018.
- Toppi, J., D. Mattia, R. Formisano, and L. Astolfi. "Windowed Wavelet Filter: a New Approach to Identify Event-Related Potentials in Disorders of Consciousness". In: *Atti del VI Congresso Nazionale del GNB, Milano, 25-27 Giugno, 2018*. 2018.
- Toppi, J., A. Ciaramidaro, C. Freitag, M. Siniatchkin, and L. Astolfi. "EEG Hyperscanning to Investigate Compassion and Altruistic Behavior". In: *Proceedings of the Annual International Conference of the IEEE Engineering in Medicine and Biology Society, EMBS*. 2018.
- Toppi, J., D. Mattia, F. Cincotti, R. Formisano, and L. Astolfi. "Windowed Wavelet Filter: A New Approach to Identify Event-Related Potentials in Disorders of Consciousness". In: *Proceedings of the Annual International Conference of the IEEE Engineering in Medicine and Biology Society, EMBS*. 2018.
- Toppi, J., D. Mattia, F. Cincotti, R. Formisano, and L. Astolfi. "Transcranial Cerebellar Direct Current Stimulation: Effects on Brain Resting State Oscillatory and Network Activity". In: *Proceedings of the Annual International Conference of the IEEE Engineering in Medicine and Biology Society, EMBS*. 2018.
- Verrienti, A., P. Paci, R. Falcone, F. Conte, M. Sponziello, G. Fiscon, V. Pecce, F. Rosignolo, G. Grani, L. Lamartina, V. Ramundo, C. Durante, L. Farina, and S. Filetti. "Network Analysis of Expression Profiling Data in Papillary Thyroid Cancer". In: *Proceedings of the Annual Meeting of the American Thyroid Association, Washington, October 3-7, 2018*. 2018.

Other (Books, Technical Reports, Submitted Papers, etc.)

- Angelini, M., G. Blasilli, L. Farina, S. Lenti, and G. Santucci. "NEMESIS (NETwork MEDicine analySIS): Towards Visual Exploration of Network Medicine Data". To appear in *VISIGRAPP 2019 - Proceedings of 14th International Joint Conference on Computer Vision, Imaging and Computer Graphics Theory and Applications*. 2019.
- Colamarino, E., F. Pichiorri, D. Mattia, and F. Cincotti. "Bipolar Filters Improve Usability of Brain-Computer Interface Technology in Post-stroke Motor Rehabilitation". To appear in *Biosystems and Biorobotics*. 2019.
- Falcone, R., F. Conte, G. Fiscon, V. Pecce, M. Sponziello, C. Durante, L. Farina, S. Filetti, P. Paci, and A. Verrienti. "BRAF V600E -Mutant Cancers Display a Variety of Networks by SWIM Analysis: Prediction of Vemurafenib Clinical Response". To appear in *Endocrine*. 2019.

- Fiscon, G., F. Conte, L. Farina, M. Pellegrini, F. Russo, and P. Paci. "Identification of Disease-miRNA Networks Across Different Cancer Types Using SWIM". To appear in *Methods in Molecular Biology*. 2019.
- Formisano, R., J. Toppi, M. Risetti, M. Aloisi, M. Contrada, P. Ciurli, C. Falletta Caravasso, G. Luccichenti, L. Astolfi, F. Cincotti, and D. Mattia. "Language-Related Brain Potentials in Patients With Disorders of Consciousness: A Follow-up Study to Detect "Covert" Language Disorders". To appear in *Neurorehabilitation and Neural Repair*. 2019.
- Gentili, M., L. Martini, M. Petti, L. Farina, and L. Becchetti. "Biological Random Walks: Integrating Heterogeneous Data in Disease Gene Prioritization". To appear in *Proceedings of the 16th IEEE International Conference on Computational Intelligence in Bioinformatics and Computational Biology, July 9-11, 2019, Siena, Italy*. 2019.
- Marinazzo, D., J. Riera, L. Marzetti, L. Astolfi, D. Yao, and P. Valdés Sosa. "Controversies in EEG Source Imaging and Connectivity: Modeling, Validation, Benchmarking". To appear in *Brain Topography*. 2019.
- Pichiorri, F., E. Colamarino, F. Cincotti, and D. Mattia. "An All-in-One BCI-Supported Motor Imagery Training Station: Validation in a Real Clinical Setting with Chronic Stroke Patients". To appear in *Biosystems and Biorobotics*. 2019.
- Tieri, P., L. Farina, M. Petti, L. Astolfi, P. Paci, and F. Castiglione. "Network Inference and Reconstruction in Bioinformatics". To appear in *Encyclopedia of Bioinformatics and Computational Biology*. 2019.

Economics

Innovation, Internationalization and the Environment

Journal Papers

Bratti, M. and C. Conti. "The Effect of Immigration on Innovation in Italy". In: *Regional Studies* 52.7 (2018), pp. 934–947. DOI: 10.1080/00343404.2017.1360483.

Conti, C., M. L. Mancusi, F. Sanna-Randaccio, R. Sestini, and E. Verdolini. "Transition Towards a Green Economy in Europe: Innovation and Knowledge Integration in the Renewable Energy Sector". In: *Research Policy* 47.10 (2018), pp. 1996–2009. DOI: <https://doi.org/10.1016/j.respol.2018.07.007>.

Conti, C. and M. A. Marini. "Are You the Right Partner? R&D Agreement as a Screening Device". In: *Economics of Innovation and New Technology* (2018). Online. DOI: 10.1080/10438599.2018.1466471.

Engineering in Computer Science

Algorithm Design and Engineering

Journal Papers

Dudnik, A., F. Almeida, R. Andrade, B. Avila, P. Bañados, D. Barbay, J.-E. Bassard, M. Benkoulouche, M. Bott, and A. B. et al. “BacHBerry: BACterial Hosts for production of Bioactive phenolics from bERRY fruits”. In: *Phytochemistry reviews* 17.2 (2018), pp. 291–326.

Conference Proceedings

Bosman, T., M. Van Ee, Y. Jiao, A. Marchetti-Spaccamela, R. Ravi, and L. Stougie. “Approximation Algorithms for Replenishment Problems with Fixed Turnover Times”. In: *Latin American Symposium on Theoretical Informatics*. Springer, Cham. 2018, pp. 217–230.

Other (Books, Technical Reports, Submitted Papers, etc.)

Ausiello, G. *The Making of a New Science*. Springer, 2018.

Algorithms and Data Science

Journal Papers

Alexander, M. and S. Chris. “Coresets-Methods and History: A Theoreticians Design Pattern for Approximation and Streaming Algorithms”. In: *KI - Kunstliche Intelligenz* 32.1 (2018), pp. 37–53. DOI: 10.1007/s13218-017-0519-3.

Anagnostopoulos, A., F. Grandoni, S. Leonardi, and A. Wiese. “A Mazing 2+ ϵ ; Approximation for Unsplittable Flow on a Path”. In: *ACM Trans. Algorithms* 14.4 (2018), 55:1–55:23. DOI: 10.1145/3242769.

Anagnostopoulos, A., F. Petroni, and M. Sorella. “Targeted Interest-Driven Advertising in Cities Using Twitter”. In: *Data Min. Knowl. Discov.* 32.3 (2018), pp. 737–763. DOI: 10.1007/s10618-017-0529-7.

Mylonas, G., D. Amaxilatis, I. Chatzigiannakis, A. Anagnostopoulos, and F. Paganelli. “Enabling Sustainability and Energy Awareness in Schools Based on IoT and Real-World Data”. In: *IEEE Pervasive Computing* 17.4 (2018), pp. 53–63. DOI: 10.1109/MPRV.2018.2873855.

Conference Proceedings

Akrivopoulos, O., N. Zhu, D. Amaxilatis, C. Tselios, A. Anagnostopoulos, and I. Chatzigiannakis. “A Fog Computing-Oriented, Highly Scalable IoT Framework for Monitoring Public Educational Buildings”. In: *2018 IEEE International Conference on Communications, ICC 2018, Kansas City, MO, USA, May 20-24, 2018*. 2018, pp. 1–6. DOI: 10.1109/ICC.2018.8422489.

- Anagnostopoulos, A., C. Castillo, A. Fazzino, S. Leonardi, and E. Terzi. "Algorithms for Hiring and Outsourcing in the Online Labor Market". In: *Proceedings of the 24th ACM SIGKDD International Conference on Knowledge Discovery & Data Mining*. KDD '18. London, United Kingdom: ACM, 2018, pp. 1109–1118. DOI: 10.1145/3219819.3220056.
- Becchetti, L., V. Bonifaci, and E. Natale. "Pooling or Sampling: Collective Dynamics for Electrical Flow Estimation". In: *Proceedings of the 17th International Conference on Autonomous Agents and MultiAgent Systems*. AAMAS '18. Stockholm, Sweden: International Foundation for Autonomous Agents and Multiagent Systems, 2018, pp. 1576–1584.
- Becchetti, L., A. E. F. Clementi, P. Manurangsi, E. Natale, F. Pasquale, P. Raghavendra, and L. Trevisan. "Average Whenever You Meet: Opportunistic Protocols for Community Detection". In: *26th Annual European Symposium on Algorithms, ESA 2018, August 20–22, 2018, Helsinki, Finland*. 2018, 7:1–7:13. DOI: 10.4230/LIPIcs.ESA.2018.7.
- Bury, M., C. Schwiegelshohn, and M. Sorella. "Sketch 'Em All: Fast Approximate Similarity Search for Dynamic Data Streams". In: *Proceedings of the Eleventh ACM International Conference on Web Search and Data Mining*. WSDM '18. Marina Del Rey, CA, USA: ACM, 2018, pp. 72–80. DOI: 10.1145/3159652.3159694.
- Menghini, C., J. D. Zufferey, and R. West. "Compiling Questions into Balanced Quizzes About Documents". In: *Proceedings of the 27th ACM International Conference on Information and Knowledge Management*. CIKM '18. Torino, Italy: ACM, 2018, pp. 1519–1522. DOI: 10.1145/3269206.3269298.
- Zhu, N., A. Anagnostopoulos, and I. Chatzigiannakis. "On Mining IoT Data for Evaluating the Operation of Public Educational Buildings". In: *2018 IEEE International Conference on Pervasive Computing and Communications Workshops, PerCom Workshops 2018, Athens, Greece, March 19–23, 2018*. 2018, pp. 278–283. DOI: 10.1109/PERCOMW.2018.8480226.

Articles in Books

- Munteanu, A., C. Schwiegelshohn, C. Sohler, and D. Woodruff. "On Coresets for Logistic Regression". In: *Advances in Neural Information Processing Systems 31*. Ed. by S. Bengio, H. Wallach, H. Larochelle, K. Grauman, N. Cesa-Bianchi, and R. Garnett. Curran Associates, Inc., 2018, pp. 6561–6570.

Other (Books, Technical Reports, Submitted Papers, etc.)

- Becchetti, L., A. E. F. Clementi, E. Natale, F. Pasquale, and L. Trevisan. "Finding a Bounded-Degree Expander Inside a Dense One". *CoRR abs/1811.10316*. 2018.
- "9th International Conference on Fun with Algorithms, FUN 2018, June 13–15, 2018, La Maddalena, Italy". 2018.
- Melanie Schmidt, C. S. and C. Sohler. "Fair Coresets and Streaming Algorithms for Fair k-Means Clustering". *CoRR abs/1812.10854*. 2018.
- "Proceedings of the 9th Italian Information Retrieval Workshop, Rome, Italy, May, 28–30, 2018". 2018.

Artificial Intelligence and Knowledge Representation

Journal Papers

Calvanese, D., G. De Giacomo, M. Montali, and F. Patrizi. "First-Order μ -Calculus over Generic Transition Systems and Applications to the Situation Calculus". In: *Inf. Comput.* 259.3 (2018), pp. 328–347. DOI: 10.1016/j.ic.2017.08.007.

Conference Proceedings

- Aminof, B., G. De Giacomo, A. Murano, and S. Rubin. "Synthesis under Assumptions". In: *Proc. of KR*. AAAI Press, 2018, pp. 615–616.
- Banihashemi, B., G. De Giacomo, and Y. Lespérance. "Abstraction of Agents Executing Online and their Abilities in the Situation Calculus". In: *Proc. of IJCAI*. ijcai.org, 2018, pp. 1699–1706.
- Banihashemi, B., G. De Giacomo, and Y. Lespérance. "Hierarchical Agent Supervision". In: *Proc. of AAMAS*. International Foundation for Autonomous Agents and Multiagent Systems Richland, SC, USA / ACM, 2018, pp. 1432–1440.
- Bisconti Lucidi, P. and D. Nardi. "Companion Robots: the Hallucinatory Danger of Human-Robot Interactions". In: *Proc. of AAAI*. 2018, pp. 17–22. DOI: 10.1145/3278721.3278741.
- Brafman, R. I., G. De Giacomo, and F. Patrizi. "LTLf/LDLf Non-Markovian Rewards". In: *Proc. of AAAI*. AAAI Press, 2018, pp. 1771–1778.
- Cecconi, A., C. D. Ciccio, G. De Giacomo, and J. Mendling. "Interestingness of Traces in Declarative Process Mining: The Janus LTLp \mathcal{f} Approach". In: *Proc. of BPM*. Vol. 11080. Lecture Notes in Computer Science. Springer, 2018, pp. 121–138.
- De Giacomo, G. and S. Rubin. "Automata-Theoretic Foundations of FOND Planning for LTLf and LDLf Goals". In: *Proc. of IJCAI*. ijcai.org, 2018, pp. 4729–4735.
- De Giacomo, G., M. Y. Vardi, P. Felli, N. Alechina, and B. Logan. "Synthesis of Orchestrations of Transducers for Manufacturing". In: *Proc. of AAAI*. AAAI Press, 2018, pp. 6161–6168.
- Lembo, D., R. Rosati, and D. F. Savo. "A Comprehensive Framework for Controlled Query Evaluation, Consistent Query Answering and KB Updates in Description Logics". In: *Proc. of KR*. 2018, pp. 653–654.
- Namici, M. and G. De Giacomo. "Comparing Query Answering in OBDA Tools over W3C-Compliant Specifications". In: *Proc. of Description Logics Workshop*. Vol. 2211. CEUR Workshop Proceedings. CEUR-WS.org, 2018.
- Vanzo, A., J. L. Part, Y. Yu, D. Nardi, and O. Lemon. "Incrementally Learning Semantic Attributes through Dialogue Interaction". In: *Proc. of AAMAS*. AAMAS '18. Stockholm, Sweden: International Foundation for Autonomous Agents and Multiagent Systems, 2018, pp. 865–873.

Articles in Books

Calvanese, D., G. De Giacomo, D. Lembo, M. Lenzerini, and R. Rosati. "Ontology-Based Data Access and Integration". In: *Encyclopedia of Database Systems (2nd ed.)* Springer, 2018.

De Giacomo, G., D. Lembo, M. Lenzerini, A. Poggi, and R. Rosati. "Using Ontologies for Semantic Data Integration". In: *A Comprehensive Guide Through the Italian Database Research*. Vol. 31. Studies in Big Data. Springer International Publishing, 2018, pp. 187–202.

Other (Books, Technical Reports, Submitted Papers, etc.)

Aminof, B., G. De Giacomo, A. Murano, and S. Rubin. "Planning and Synthesis Under Assumptions". *CoRR abs/1807.06777*. 2018.

Batusov, V., G. De Giacomo, and M. Soutchanski. "Hybrid Temporal Situation Calculus". *CoRR abs/1807.04861*. 2018.

De Giacomo, G., L. Iocchi, M. Favorito, and F. Patrizi. "Reinforcement Learning for LTLf/LDLf Goals". *CoRR abs/1807.06333*. 2018.

De Giacomo, G., B. Logan, P. Felli, F. Patrizi, and S. Sardiña. "Situation Calculus for Synthesis of Manufacturing Controllers". *CoRR abs/1807.04561*. 2018.

Artificial Intelligence and Robotics

Journal Papers

Albani, D. and V. Trianni. "Drone Swarms in the Field". In: *ERCIM News* 113 (2018), pp. 31–32.

Basso, F., E. Menegatti, and A. Pretto. "Robust Intrinsic and Extrinsic Calibration of RGB-D Cameras". In: *IEEE Transactions on Robotics* 34.5 (2018), pp. 1315–1332. DOI: 10.1109/TRO.2018.2853742.

Carbone, C., O. Garibaldi, and Z. Kurt. "Swarm Robotics as a Solution to Crops Inspection for Precision Agriculture". In: *KnE Engineering* 3.1 (2018), p. 552. DOI: 10.18502/keg.v3i1.1459.

Duchetto, F. D., A. Küçükyılmaz, L. Iocchi, and M. Hanheide. "Do Not Make the Same Mistakes Again and Again: Learning Local Recovery Policies for Navigation From Human Demonstrations". In: *IEEE Robotics and Automation Letters* 3.4 (2018), pp. 4084–4091. DOI: 10.1109/LRA.2018.2861080.

Imperoli, M., C. Potena, D. Nardi, G. Grisetti, and A. Pretto. "An Effective Multi-Cue Positioning System for Agricultural Robotics". In: *IEEE Robotics and Automation Letters* 3.4 (2018), pp. 3685–3692. DOI: 10.1109/LRA.2018.2855052.

Schlegel, D. and G. Grisetti. "HBST: A Hamming Distance Embedding Binary Search Tree for Feature-based Visual Place Recognition". In: *IEEE Robotics and Automation Letters* 3.4 (2018), pp. 3741–3748. DOI: 10.1109/LRA.2018.2856542.

Conference Proceedings

Albani, D., T. Manoni, D. Nardi, and V. Trianni. "Dynamic UAV Swarm Deployment for Non-Uniform Coverage". In: *Proceedings of the 17th International Conference on Autonomous Agents and MultiAgent Systems*. International Foundation for Autonomous Agents and Multiagent Systems. 2018, pp. 523–531.

- Capobianco, R., F. Riccio, and D. Nardi. "Hi-Val: Iterative Learning of Hierarchical Value Functions for Policy Generation". In: *Proceedings of the Fifteenth International Conference on Intelligent Autonomous Systems IAS-15*. 2018, pp. 414–427.
- Della Corte, B., I. Bogoslavsky, C. Stachniss, and G. Grisetti. "A General Framework for Flexible Multi-Cue Photometric Point Cloud Registration". In: *2018 IEEE International Conference on Robotics and Automation (ICRA)*. 2018, pp. 1–8.
- Ferrarelli, P., W. Villa, M. Attolini, D. Cesareni, F. Micale, N. Sansone, L. C. Pantaleone, and L. Iocchi. "Improving Students Concepts about Newtonian Mechanics Using Mobile Robots". In: *International Conference on Robotics and Education RiE 2018*. Springer. 2018.
- Lázaro, M. T., R. Capobianco, and G. Grisetti. "Efficient Long-Term Mapping in Dynamic Environments". In: *2018 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)*. IEEE. 2018, pp. 153–160.
- Leggeri, S., A. Esposito, and L. Iocchi. "Task-Oriented Conversational Agent Self-learning Based on Sentiment Analysis". In: *Proceedings of the 2nd Workshop on Natural Language for Artificial Intelligence (NL4AI 2018) co-located with 17th International Conference of the Italian Association for Artificial Intelligence (AI*IA 2018), Trento, Italy, November 22nd to 23rd, 2018*. 2018, pp. 4–15.
- Nardi, F., B. Della Corte, and G. Grisetti. "Unified Representation of Heterogeneous Sets of Geometric Primitives". In: *ICRA18 Workshop on Perception, Inference, and Learning for Joint Semantic, Geometric, and Physical Understanding*. 2018.
- Pisa, S., E. Piuzzi, E. Pittella, P. Lombardo, A. Genovese, D. Bloisi, D. Nardi, P. d'Atanasio, and A. Zambotti. "Numerical and Experimental Evaluation of the Radar Cross Section of a Drone". In: *2018 15th European Radar Conference (EuRAD)*. IEEE. 2018, pp. 309–312.
- Pisa, S., E. Piuzzi, E. Pittella, P. Lombardo, N. Ustalli, W. Cao, D. Bloisi, D. Nardi, P. D'Atanasio, and A. Zambotti. "Evaluating the Radar Cross Section of the Commercial IRIS Drone for Anti-Drone Passive Radar Source Selection". In: *2018 22nd International Microwave and Radar Conference (MIKON)*. IEEE. 2018, pp. 699–703.
- Potena, C., B. Della Corte, D. Nardi, G. Grisetti, and A. Pretto. "Non-Linear Model Predictive Control with Adaptive Time-Mesh Refinement". In: *2018 IEEE International Conference on Simulation, Modeling, and Programming for Autonomous Robots (SIMPAN)*. 2018, pp. 74–80.
- Riccio, F., R. Capobianco, and D. Nardi. "DOP: Deep Optimistic Planning with Approximate Value Function Evaluation". In: *Proceedings of the 17th International Conference on Autonomous Agents and MultiAgent Systems*. AAMAS '18. Stockholm, Sweden: International Foundation for Autonomous Agents and Multiagent Systems, 2018, pp. 2210–2212.
- Riccio, F., R. Capobianco, and D. Nardi. "Q-CP: Learning Action Values for Cooperative Planning". In: *2018 IEEE International Conference on Robotics and Automation (ICRA)*. 2018, pp. 6469–6475.
- Schlegel, D., M. Colosi, and G. Grisetti. "ProSLAM: Graph SLAM from a Programmer's Perspective". In: *2018 IEEE International Conference on Robotics and Automation (ICRA)*. 2018, pp. 1–9.

Schlegel, D. and G. Grisetti. “Adding Cues to Binary Feature Descriptors for Visual Place Recognition”. In: *2018 IEEE International Conference on Robotics and Automation (ICRA)*. 2018.

Articles in Books

Aldegheri, S., D. D. Bloisi, J. J. Blum, N. Bombieri, and A. Farinelli. “Fast and Power-Efficient Embedded Software Implementation of Digital Image Stabilization for Low-Cost Autonomous Boats”. In: *Field and Service Robotics: Results of the 11th International Conference*. Ed. by M. Hutter and R. Siegwart. Cham: Springer International Publishing, 2018, pp. 129–144. DOI: 10.1007/978-3-319-67361-5_9.

Other (Books, Technical Reports, Submitted Papers, etc.)

Albani, D., W. Hoenig, D. Nardi, N. Ayanian, and V. Trianni. “Summary: Distributed Task Assignment and Path Planning with Limited Communication for Robot Teams”. To appear in *Proceedings of the 18th International Conference on Autonomous Agents and MultiAgent Systems*. 2019.

Aloise, I., B. Della Corte, F. Nardi, and G. Grisetti. “Systematic Handling of Heterogeneous Geometric Primitives in Graph-SLAM Optimization”. To appear in *IEEE Robotics and Automation Letters*. 2019.

Aloise, I. and G. Grisetti. “Matrix Difference in Pose-Graph Optimization”. *CoRR abs/1809.00952*. 2018.

Bullard, K., N. DePalma, R. G. Freedman, B. Hayes, L. Iocchi, K. S. Lohan, R. Mead, E. Senft, and T. Williams. “Proceedings of the AI-HRI Symposium at AAAI-FSS 2018”. *CoRR abs/1809.06606*. 2018.

Della Corte, B., H. Andreasson, T. Stoyanov, and G. Grisetti. “Unified Motion-Based Calibration of Mobile Multi-Sensor Platforms with Time Delay Estimation”. To appear in *IEEE Robotics and Automation Letters*. 2019.

Di Giambattista, V., M. Fawakherji, V. Suriani, D. D. Bloisi, and D. Nardi. “On Field Gesture-based Robot-to-Robot Communication with NAO Soccer Players”. To appear in *Proceedings of the 23th International RoboCup Symposium*. 2019.

Fawakherji, M., A. Youssef, D. D. Bloisi, A. Pretto, and D. Nardi. “Crop and Weeds Classification for Precision Agriculture Using Context-Independent Pixel-Wise Segmentation”. To appear at *2019 Third IEEE International Conference on Robotic Computing (IRC)*. 2019.

Massouh, N., L. Brigato, and L. Iocchi. “RoboCup@Home-Objects: Benchmarking Object Recognition”. To appear in *Proceedings of the 23th International RoboCup Symposium*. 8, 2019.

Nardi, F., B. Della Corte, and G. Grisetti. “Unified Representation and Registration of Heterogeneous Sets of Geometric Primitives”. To appear in *IEEE Robotics and Automation Letters*. 2019.

Ocana, C., J. Martin, F. Riccio, R. Capobianco, and D. Nardi. “Cooperative Multi-Agent Deep Reinforcement Learning in a 2 Versus 2 Free-Kick Task”. To appear in *Proceedings of the 23th International RoboCup Symposium*. 2019.

- Ocana, C., J. Martin, F. Riccio, R. Capobianco, and D. Nardi. "Cooperative Multi-Agent Deep Reinforcement Learning in Soccer Domains". To appear in *Proceedings of the 18th International Conference on Autonomous Agents and MultiAgent Systems*. Montreal QC, Canada, 2019.
- Potena, C., R. Khanna, J. Nieto, R. Siegwart, D. Nardi, and A. Pretto. "AgriColMap: Aerial-Ground Collaborative 3D Mapping for Precision Farming". To appear in *IEEE Robotics and Automation Letters*. 2019.
- Wang, L., A. Marrella, and D. Nardi. "Investigating User Perceptions of HRI in Social Contexts". To appear at *2019 14th ACM/IEEE International Conference on Human-Robot Interaction (HRI)*. 2019.

Computer Networks and Pervasive Systems

Journal Papers

- Amaxilatis, D. and I. Chatzigiannakis. "Design and Analysis of Adaptive Hierarchical Low-Power Long-Range Networks". In: *J. Sensor and Actuator Networks 7.4* (2018), p. 51. DOI: 10.3390/jsan7040051.
- Angeletti, F., I. Chatzigiannakis, and A. Vitaletti. "Towards an Architecture to Guarantee Both Data Privacy and Utility in the First Phases of Digital Clinical Trials". In: *Sensors 18.12* (2018), p. 4175. DOI: 10.3390/s18124175.

Conference Proceedings

- Akrivopoulos, O., D. Amaxilatis, I. Mavrommati, and I. Chatzigiannakis. "Utilising Fog Computing for Developing a Person-Centric Heart Monitoring System". In: *14th International Conference on Intelligent Environments, IE 2018, Roma, Italy, June 25-28, 2018*. 2018, pp. 9–16. DOI: 10.1109/IE.2018.00010.
- Beraldi, R. and H. M. Alnuweiri. "Sequential Randomization Load Balancing for Fog Computing". In: *26th International Conference on Software, Telecommunications and Computer Networks, SoftCOM 2018, Split, Croatia, September 13-15, 2018*. 2018, pp. 1–6. DOI: 10.23919/SOFTCOM.2018.8555797.
- Beraldi, R., A. Mtibaa, and A. N. Mian. "CICO: A Credit-Based Incentive Mechanism for COoperative Fog Computing Paradigms". In: *IEEE Global Communications Conference, GLOBECOM 2018, Abu Dhabi, United Arab Emirates, December 9-13, 2018*. 2018, pp. 1–7. DOI: 10.1109/GLOCOM.2018.8647959.
- Nousias, S., C. Tselios, D. Bitzas, A. S. Lalos, K. Moustakas, and I. Chatzigiannakis. "Uncertainty Management for Wearable IoT Wristband Sensors Using Laplacian-Based Matrix Completion". In: *23rd IEEE International Workshop on Computer Aided Modeling and Design of Communication Links and Networks, CAMAD 2018, Barcelona, Spain, September 17-19, 2018*. 2018, pp. 1–6. DOI: 10.1109/CAMAD.2018.8515001.
- Tziortzioti, C., G. Andreotti, L. Rodinò, I. Mavrommati, A. Vitaletti, and I. Chatzigiannakis. "Raising Awareness for Water Pollution Based on Game Activities Using Internet of Things". In: *Ambient Intelligence - 14th European Conference, Aml 2018, Larnaca, Cyprus, November 12-14, 2018, Proceedings*. 2018, pp. 171–187. DOI: 10.1007/978-3-030-03062-9_14.

Computer Vision, Computer Graphics, and Perception

Conference Proceedings

- Mauro, L., E. Alati, M. Sanzari, V. Ntouskos, G. Massimiani, and F. Pirri. "Deep Execution Monitor for Robot Assistive Tasks". In: *Proceedings of the European Conference on Computer Vision (ECCV)*. 2018.
- Ntouskos, V., M. Sanzari, E. Alati, L. Freda, and F. Pirri. "Visual Search and Recognition for Robot Task Execution and Monitoring". In: *Applications of Intelligent Systems: Proceedings of the 1st International APPIS Conference 2018*. Vol. 310. IOS Press. 2018, p. 94.

Other (Books, Technical Reports, Submitted Papers, etc.)

- Alati, E., L. Mauro, V. Ntouskos, and F. Pirri. "Help by Predicting What To Do". To appear in *Proceedings of the International Conference on Image Processing (ICIP)*. 2019.
- Freda, L., M. Gianni, and F. Pirri. "A Hybrid Approach for Trajectory Control Design". *arXiv preprint arXiv:1810.03711*. 2018.
- Freda, L., M. Gianni, F. Pirri, A. Gawel, R. Dubé, R. Siegwart, and C. Cadena. "3D Multi-Robot Patrolling with a Two-Level Coordination Strategy". To appear in *Autonomous Robots*. 2019.
- Garcia, M. A. R., R. A. Rojas, and F. Pirri. "Object-Centered Teleoperation of Mobile Manipulators with Remote Center of Motion Constraint". To appear in *IEEE Robotics and Automation Letters*. 2019.
- Pirri, F. "Anticipating Next Goal for Robot Plan Prediction". To appear in *Advances in Intelligent Systems and Computing*. 2019.
- Pirri, F., L. Mauro, E. Alati, V. Ntouskos, M. Izadpanahkakhk, and E. Omrani. "Anticipation and Next Action Forecasting in Video: an End-to-End Model with Memory". *arXiv preprint arXiv:1901.03728*. 2019.
- Puja, F., S. Grazioso, A. Tammara, V. Ntouskos, M. Sanzari, and F. Pirri. "Vision-Based Deep Execution Monitoring". *arXiv preprint arXiv:1709.10507*. 2018.
- Sanzari, M., V. Ntouskos, and F. Pirri. "Discovery and Recognition of Motion Primitives in Human Activities". To appear in *PloS one*. 2019.

Cybersecurity

Journal Papers

- Adamsky, F., M. Aubigny, F. Battisti, M. Carli, F. Cimorelli, T. Cruz, A. Di Giorgio, C. Foglietta, A. Galli, A. Giuseppi, F. Liberati, A. Neri, S. Panziera, F. Pascucci, J. Proenca, P. Pucci, L. Rosa, and R. Soua. "Integrated Protection of Industrial Control Systems from Cyber-Attacks: the ATENA approach". In: *International Journal of Critical Infrastructure Protection* 21 (2018), pp. 72–82. DOI: 10.1016/j.ijcip.2018.04.004.
- Baldoni, R., E. Coppa, D. C. D'Elia, C. Demetrescu, and I. Finocchi. "A Survey of Symbolic Execution Techniques". In: *ACM Comput. Surv.* 51.3 (2018), 50:1–50:39. DOI: 10.1145/3182657.

- Di Giorgio, A., A. Pietrabissa, F. Delli Priscoli, and A. Isidori. "Robust Protection Scheme Against Cyberphysical Attacks in Power Systems". In: *IET Control Theory and Applications* 12.13 (2018), pp. 1792–1801. DOI: 10.1049/iet--cta.2017.0725.
- Ganino, G., D. Lembo, M. Mecella, and F. Scafoglieri. "Ontology Population for Open-Source Intelligence: A GATE-Based Solution". In: *Softw., Pract. Exper.* 48.12 (2018), pp. 2302–2330. DOI: 10.1002/spe.2640.
- Luo, Y., S. S. Cheung, R. Lazzeretti, T. Pignata, and M. Barni. "Anonymous Subject Identification and Privacy Information Management in Video Surveillance". In: *Int. J. Inf. Sec.* 17.3 (2018), pp. 261–278. DOI: 10.1007/s10207-017-0380-2.

Conference Proceedings

- Angelini, M., G. Blasilli, P. Borrello, E. Coppa, D. C. D'Elia, S. Ferracci, S. Lenti, and G. Santucci. "ROPMate: Visually Assisting the Creation of ROP-based Exploits". In: *IEEE Symposium on Visualization for Cyber Security, VizSec 2018, Berlin, Germany, October 22, 2018*. 2018, pp. 1–8. DOI: 10.1109/VIZSEC.2018.8709204.
- Angelini, M., G. Blasilli, S. Lenti, and G. Santucci. "Visual Exploration and Analysis of the Italian Cybersecurity Framework". In: *Proceedings of the 2018 International Conference on Advanced Visual Interfaces, AVI 2018, Castiglione della Pescaia, Italy, May 29 - June 01, 2018*. 2018, 55:1–55:3. DOI: 10.1145/3206505.3206579.
- Angelini, M., S. Bonomi, E. Borzi, A. D. Pozzo, S. Lenti, and G. Santucci. "An Attack Graph-based On-line Multi-step Attack Detector". In: *Proceedings of the 19th International Conference on Distributed Computing and Networking, ICDCN 2018, Varanasi, India, January 4-7, 2018*. 2018, 40:1–40:10. DOI: 10.1145/3154273.3154311.
- Capossele, A., A. Gaglione, M. Nati, M. Conti, R. Lazzeretti, and P. Missier. "Leveraging Blockchain to Enable Smart-Health Applications". In: *IEEE 4th International Forum on Research and Technology for Society and Industry, RTSI 2018, Palermo, Italy, September 10-13, 2018*. 2018, pp. 1–6. DOI: 10.1109/RTSI.2018.8548357.
- Compagno, A., M. Conti, S. Munari, and R. Lazzeretti. "GATE and FENCE: Geo-Blocking Protocols for Named Data Networking". In: *43rd IEEE Conference on Local Computer Networks, LCN 2018, Chicago, IL, USA, October 1-4, 2018*. 2018, pp. 580–588. DOI: 10.1109/LCN.2018.8638053.
- D'Elia, D. C. and C. Demetrescu. "On-Stack Replacement, Distilled". In: *Proceedings of the 39th ACM SIGPLAN Conference on Programming Language Design and Implementation, PLDI 2018, Philadelphia, PA, USA, June 18-22, 2018*. 2018, pp. 166–180. DOI: 10.1145/3192366.3192396.
- Ganino, G., D. Lembo, M. Mecella, and F. Scafoglieri. "Ontology Population for Open-Source Intelligence (Discussion Paper)". In: *Proceedings of the 26th Italian Symposium on Advanced Database Systems (SEBD 2018)*. 2018.
- Ganino, G., D. Lembo, and F. Scafoglieri. "Ontology Population from Raw Text Corpus for Open-Source Intelligence". In: *Current Trends in Web Engineering*. Cham: Springer International Publishing, 2018, pp. 173–186.
- Giuseppi, A., R. Germaná, and A. Di Giorgio. "Risk Adverse Virtual Power Plant Control in Unsecure Power Systems". In: *Proc. of 26th Mediterranean Conference on Control and Automation (MED 2018)*. 2018, pp. 210–216. DOI: 10.1109/MED.2018.8442768.

Panfili, M., A. Giuseppi, A. Fiaschetti, H. B. Al-Jibreen, A. Pietrabissa, and F. Delli Priscoli. "A Game-Theoretical Approach to Cyber-Security of Critical Infrastructures Based on Multi-Agent Reinforcement Learning". In: *Proc. of 26th Mediterranean Conference on Control and Automation (MED 2018)*. 2018, pp. 460–465. DOI: 10.1109/MED.2018.8442695.

Articles in Books

Elingiusti, M., L. Aniello, L. Querzoni, and R. Baldoni. "PDF-Malware Detection: a Survey and Taxonomy of Current Techniques". In: *Cyber Threat Intelligence*. Ed. by M. Conti, T. Dargahi, and A. Dehghantanha. Advanced in Information Security. Springer, 2018, pp. 169–191.

Other (Books, Technical Reports, Submitted Papers, etc.)

Ambrosin, M., M. Conti, R. Lazzeretti, M. M. Rabbani, and S. Ranise. "PADS: Practical Attestation for Highly Dynamic Swarm Topologies". *CoRR abs/1806.05766*. 2018.

Bo, P., A. Granato, M. E. Mancuso, C. Ciccotelli, and L. Querzoni. "FADa-CPS—Faults and Attacks Discrimination in Cyber Physical Systems". To appear in *Lecture Notes in Computer Science*. 2019.

Bonomi, S., M. Casini, and C. Ciccotelli. "B-CoC: A Blockchain-Based Chain of Custody for Evidences Management in Digital Forensics". *CoRR abs/1807.10359*. 2018.

Borrello, P., E. Coppa, D. C. D'Elia, and C. Demetrescu. "The ROP Needle: Hiding Trigger-Based Injection Vectors Via Code Reuse". To appear in *Proceedings of the 34th ACM/SIGAPP Symposium on Applied Computing SAC 2019*. 2019.

Borzacchiello, L., E. Coppa, D. C. D'Elia, and C. Demetrescu. "Reconstructing C2 Servers for Remote Access Trojans with Symbolic Execution". To appear at *Cyber Security Cryptography and Machine Learning - Third International Symposium, CSCML 2019*. 2019.

D'Elia, D. C., E. Coppa, S. Nicchi, F. Palmaro, and L. Cavallaro. "SoK: Using Dynamic Binary Instrumentation for Security (And How You May Get Caught Red Handed)". To appear in *Proceedings of the 14th ACM ASIA Conference on Computer and Communications Security*. 2019.

D'Elia, D. C., E. Coppa, A. Salvati, and C. Demetrescu. "Static Analysis of ROP Code". To appear in *Proceedings of the 12th European Workshop on Systems Security, EuroSecEuroSys2019*. 2019.

Droandi, G., M. Barni, R. Lazzeretti, and T. Pignata. "SEMBA: SEcure Multi-Biometric Authentication". *CoRR abs/1803.10758*. 2018.

Laurenza, G., R. Lazzeretti, and L. Mazzotti. "Malware Triage for Early Identification of Advanced Persistent Threat Activities". *CoRR abs/1810.07321*. 2018.

Massarelli, L., G. A. Di Luna, F. Petroni, L. Querzoni, and R. Baldoni. "Investigating Graph Embedding Neural Networks with Unsupervised Features Extraction for Binary Analysis". To appear in *Proceedings of the Workshop on Binary Analysis Research (BAR)*. 2019.

- Massarelli, L., G. A. Di Luna, F. Petroni, L. Querzoni, and R. Baldoni. "SAFE: Self-Attentive Function Embeddings for Binary Similarity". To appear in *Proceedings of the 16th Conference on Detection of Intrusions and Malware & Vulnerability Assessment (DIMVA)*. 2019.
- Massarelli, L., G. A. Di Luna, F. Petroni, L. Querzoni, and R. Baldoni. "YARASAFE: Automatic Binary Function Similarity Checks with Yara". To appear in *BlackHat USA Arsenal*. 2019.
- Petagna, E., G. Laurenza, C. Ciccotelli, and L. Querzoni. "Peel the Onion: Recognition of Android Apps Behind the Tor Network". To appear in *CoRR abs/1901.04434*. 2019.
- Tanasache, F. D., M. Sorella, S. Bonomi, R. Rapone, and D. Meacci. "Building an emulation environment for cyber security analyses of complex networked systems". To appear in *Proceedings of the 20th International Conference on Distributed Computing and Networking, ICDCN 2019*. 2019.

Data Management and Service-Oriented Computing

Journal Papers

- Catarci, T. "Foreword from the New JDIQ Editor-in-Chief". In: *J. Data and Information Quality* 9.2 (2018), 8:1–8:2. DOI: 10.1145/3143316.
- Ceravolo, P., A. Azzini, M. Angelini, T. Catarci, P. Cudré-Mauroux, E. Damiani, A. Mazak, M. van Keulen, M. Jarrar, G. Santucci, K. Sattler, M. Scannapieco, M. Wimmer, R. Wrembel, and F. A. Zaraket. "Big Data Semantics". In: *J. Data Semantics* 7.2 (2018), pp. 65–85. DOI: 10.1007/s13740-018-0086-2.
- Lenbo, D., D. Pantaleone, V. Santarelli, and D. F. Savo. "Drawing OWL 2 Ontologies with Eddy the Editor". In: *AI Commun.* 31.1 (2018), pp. 97–113. DOI: 10.3233/AIC-180751.
- Lenzerini, M. "Managing Data Through the Lens of an Ontology". In: *AI Magazine* 39.2 (2018), pp. 65–74. DOI: 10.1609/aimag.v39i2.2802.
- Marrella, A., M. Mecella, and S. Sardiña. "Supporting Adaptiveness of Cyber-Physical Processes through Action-Based Formalisms". In: *AI Commun.* 31.1 (2018), pp. 47–74. DOI: 10.3233/AIC-170748.

Conference Proceedings

- Bartolomeo, S. D., G. Pepe, V. Santarelli, and D. F. Savo. "The SPARQLING System for SPARQL Queries over GRAPHOL ontologies". In: *Proc. of the ISWC 2018 Posters & Demonstrations, Industry and Blue Sky Ideas Tracks co-located with 17th International Semantic Web Conference (ISWC 2018)*. 2018.
- Bartolomeo, S. D., G. Pepe, D. F. Savo, and V. Santarelli. "Sparqling: Painlessly Drawing SPARQL Queries over Graphol Ontologies". In: *Proc. of the Fourth International Workshop on Visualization and Interaction for Ontologies and Linked Data co-located with the 17th International Semantic Web Conference, VOILA@ISWC 2018*. 2018, pp. 64–69.
- Croce, F. and M. Lenzerini. "A Framework for Explaining Query Answers in DL-Lite". In: *Knowledge Engineering and Knowledge Management - 21st International Conference, EKAW 2018*. 2018, pp. 83–97. DOI: 10.1007/978-3-030-03667-6_6.

- de Leoni, M., G. Lanciano, and A. Marrella. "Aligning Partially-Ordered Process-Execution Traces and Models Using Automated Planning". In: *Proc. of the Twenty-Eighth International Conference on Automated Planning and Scheduling, ICAPS 2018*. 2018, pp. 321–329.
- Lenzerini, M., W. Martens, and N. Schweikardt. "2018 ACM PODS Alberto O. Mendelzon Test-of-Time Award". In: *Proc. of the 37th ACM SIGMOD-SIGACT-SIGAI Symposium on Principles of Database Systems*. 2018, p. 105. DOI: 10.1145/3196959.3196993.
- Maggi, F. M., A. Marrella, G. Capezuto, and A. Armas-Cervantes. "Explaining Non-compliance of Business Process Models Through Automated Planning". In: *Service-Oriented Computing - 16th International Conference, ICSOC 2018*. 2018, pp. 181–197. DOI: 10.1007/978-3-030-03596-9_12.
- Xiao, G., D. Calvanese, R. Kontchakov, D. Lembo, A. Poggi, R. Rosati, and M. Zakharyashev. "Ontology-Based Data Access: A Survey". In: *Proc. of the Twenty-Seventh International Joint Conference on Artificial Intelligence, IJCAI 2018*. 2018, pp. 5511–5519. DOI: 10.24963/ijcai.2018/777.

Articles in Books

- Poggi, A. "Il Progetto MAGISTER - Ricerca e Innovazione a Servizio del Territorio". In: Franco Angeli, 2018. Chap. L'Ontology-Based Data Access come strumento per la valorizzazione di un territorio, pp. 34–46.

Other (Books, Technical Reports, Submitted Papers, etc.)

- Akerkar, R., M. Ivanovic, S. Kim, Y. Manolopoulos, R. Rosati, M. Savic, C. Badica, and M. Radovanovic, eds. *Proc. of the 8th International Conference on Web Intelligence, Mining and Semantics, WIMS 2018*. ACM, 2018.
- Marrella, A. and M. Mecella. "Cognitive Business Process Management for Adaptive Cyber-Physical Processes". *CoRR abs/1802.02986*. 2018.
- Marrella, A., M. Mecella, M. Sharf, and T. Catarci. "The TESTMED Project Experience. Process-aware Enactment of Clinical Guidelines through Multimodal Interfaces". *CoRR abs/1807.02022*. 2018.

Distributed Systems

Journal Papers

- Bonomi, S., A. Del Pozzo, and M. Potop-Butucaru. "Optimal Self-Stabilizing Synchronous Mobile Byzantine-Tolerant Atomic Register". In: *Theor. Comput. Sci.* 709 (2018), pp. 64–79. DOI: 10.1016/j.tcs.2017.08.020.
- Lombardi, F., L. Aniello, S. Bonomi, and L. Querzoni. "Elastic Symbiotic Scaling of Operators and Resources in Stream Processing Systems". In: *IEEE Trans. Parallel Distrib. Syst.* 29.3 (2018), pp. 572–585. DOI: 10.1109/TPDS.2017.2762683.

Conference Proceedings

- Beraldi, R. and H. M. Alnuweiri. "Sequential Randomization load balancing for Fog Computing". In: *26th International Conference on Software, Telecommunications and Computer Networks, SoftCOM 2018, Split, Croatia, September 13-15, 2018*. 2018, pp. 1–6.
- Beraldi, R., A. Mtibaa, and A. N. Mian. "CICO: A Credit-Based Incentive Mechanism for COoperative Fog Computing Paradigms". In: *IEEE Global Communications Conference, GLOBECOM 2018, Abu Dhabi, United Arab Emirates, December 9-13, 2018*. 2018, pp. 1–7.
- Bonomi, S., A. Del Pozzo, M. Potop-Butucaru, and S. Tixeuil. "Brief Announcement: Optimal Self-stabilizing Mobile Byzantine-Tolerant Regular Register with Bounded Timestamps". In: *Stabilization, Safety, and Security of Distributed Systems - 20th International Symposium, SSS 2018, Tokyo, Japan, November 4-7, 2018, Proceedings*. 2018, pp. 398–403. DOI: 10.1007/978-3-030-03232-6_28.
- Bonomi, S., G. Farina, and S. Tixeuil. "Multi-hop Byzantine Reliable Broadcast Made Practical". In: *8th Latin-American Symposium on Dependable Computing, LADC 2018, Foz do Iguaçu, Brazil, October 8-10, 2018*. 2018, pp. 155–160. DOI: 10.1109/LADC.2018.00026.
- Bonomi, S., G. Farina, and S. Tixeuil. "Reliable Broadcast in Dynamic Networks with Locally Bounded Byzantine Failures". In: *Stabilization, Safety, and Security of Distributed Systems - 20th International Symposium, SSS 2018, Tokyo, Japan, November 4-7, 2018, Proceedings*. 2018, pp. 170–185. DOI: 10.1007/978-3-030-03232-6_12.
- Shaer, A., S. Dolev, S. Bonomi, M. Raynal, and R. Baldoni. "Bee's Strategy Against Byzantines Replacing Byzantine Participants - (Extended Abstract)". In: *Stabilization, Safety, and Security of Distributed Systems - 20th International Symposium, SSS 2018, Tokyo, Japan, November 4-7, 2018, Proceedings*. 2018, pp. 139–153. DOI: 10.1007/978-3-030-03232-6_10.

Other (Books, Technical Reports, Submitted Papers, etc.)

- Bonomi, S. and E. Rivière, eds. *Distributed Applications and Interoperable Systems - 18th IFIP WG 6.1 International Conference, DAIS 2018, Held as Part of the 13th International Federated Conference on Distributed Computing Techniques, DisCoTec 2018, Madrid, Spain, June 18-21, 2018, Proceedings*. Vol. 10853. Lecture Notes in Computer Science. Springer, 2018. DOI: 10.1007/978-3-319-93767-0.

High Performance and Dependable Computing Systems

Conference Proceedings

- Conoci, S., D. Cingolani, P. di Sanzo, B. Ciciani, A. Pellegrini, and F. Quaglia. "A Power Cap Oriented Time Warp Architecture". In: *Proceedings of the 2018 ACM SIGSIM Conference on Principles of Advanced Discrete Simulation, Rome, Italy, May 23-25, 2018*. 2018, pp. 97–100. DOI: 10.1145/3200921.3200930.

- Conoci, S., P. di Sanzo, B. Ciciani, and F. Quaglia. "Adaptive Performance Optimization under Power Constraint in Multi-thread Applications with Diverse Scalability". In: *Proceedings of the 2018 ACM/SPEC International Conference on Performance Engineering, ICPE 2018, Berlin, Germany, April 09-13, 2018*. 2018, pp. 16–27. DOI: 10.1145/3184407.3184419.
- Economo, S., E. Silvestri, P. di Sanzo, A. Pellegrini, and F. Quaglia. "Model-Based Proactive Read-Validation in Transaction Processing Systems". In: *24th IEEE International Conference on Parallel and Distributed Systems, ICPADS 2018, Singapore, December 11-13, 2018*. 2018, pp. 481–488. DOI: 10.1109/PADSW.2018.8644605.
- Ianni, M., R. Marotta, D. Cingolani, A. Pellegrini, and F. Quaglia. "Optimizing simulation on Shared-Memory Platforms: the Smart Cities Case". In: *2018 Winter Simulation Conference, WSC 2018, Gothenburg, Sweden, December 9-12, 2018*. 2018, pp. 1969–1980. DOI: 10.1109/WSC.2018.8632301.
- Ianni, M., R. Marotta, D. Cingolani, A. Pellegrini, and F. Quaglia. "The Ultimate Share-Everything PDES System". In: *Proceedings of the 2018 ACM SIGSIM Conference on Principles of Advanced Discrete Simulation, Rome, Italy, May 23-25, 2018*. 2018, pp. 73–84. DOI: 10.1145/3200921.3200931.
- Marotta, R., M. Ianni, A. Scarselli, A. Pellegrini, and F. Quaglia. "A Non-blocking Buddy System for Scalable Memory Allocation on Multi-core Machines". In: *IEEE International Conference on Cluster Computing, CLUSTER 2018, Belfast, UK, September 10-13, 2018*. 2018, pp. 164–165. DOI: 10.1109/CLUSTER.2018.00034.
- Principe, M., T. Tocci, A. Pellegrini, and F. Quaglia. "Porting Event & Cross-State Synchronization to the Cloud". In: *Proceedings of the 2018 ACM SIGSIM Conference on Principles of Advanced Discrete Simulation, Rome, Italy, May 23-25, 2018*. 2018, pp. 177–188. DOI: 10.1145/3200921.3200929.

Human-Computer Interaction

Journal Papers

- Angelini, M., V. Fazzini, N. Ferro, G. Santucci, and G. Silvello. "CLAIRE: A Combinatorial Visual Analytics System for Information Retrieval Evaluation". In: *Inf. Process. Manage.* 54.6 (2018), pp. 1077–1100. DOI: 10.1016/j.ipm.2018.04.006.
- Angelini, M., G. Santucci, H. Schumann, and H. Schulz. "A Review and Characterization of Progressive Visual Analytics". In: *Informatics* 5.3 (2018), p. 31. DOI: 10.3390/informatics5030031.
- Gaspiretti, F., C. De Medio, C. Limongelli, F. Sciarrone, and M. Temperini. "Prerequisites Between Learning Objects: Automatic Extraction Based on a Machine Learning Approach". In: *Telematics and Informatics* 35(3) (2018), pp. 595–610. DOI: 10.1016/j.tele.2017.05.007.
- Mecella, M., F. Leotta, A. Marrella, F. Palucci, C. Seri, and T. Catarci. "Encouraging Persons to Visit Cultural Sites Through Mini-Games". In: *EAI Endorsed Trans. Serious Games* 4.14 (2018), e3. DOI: 10.4108/eai.4-1-2018.153531.

Conference Proceedings

- Angelini, M., L. Bardone, M. Geymonat, M. Mirabelli, C. Remondino, G. Santucci, B. Stabellini, and P. M. Tamborrini. "A Visual Analytics System for Managing Mobile Network Failures". In: *EuroVis Workshop on Visual Analytics, EuroVA 2018, Brno, Czech Republic, 4 June 2018*. 2018, pp. 25–29. DOI: 10.2312/eurova.20181108.
- Angelini, M., G. Blasilli, S. Lenti, and G. Santucci. "Guess What I Want: I am in Hurry and I am Using my Phone while Driving". In: *22nd International Conference Information Visualisation, IV 2018, Fisciano, Italy, July 10-13, 2018*. 2018, pp. 139–144. DOI: 10.1109/iv.2018.00034.
- Angelini, M., G. Blasilli, S. Lenti, and G. Santucci. "STEIN: Speeding up Evaluation Activities With a Seamless Testing Environment INtegrator". In: *Eurographics Conference on Visualization, EuroVis 2018, Short Papers, Brno, Czech Republic, 4-8 June 2018*. 2018, pp. 85–89. DOI: 10.2312/eurovisshort.20181083.
- Angelini, M., G. Blasilli, S. Lenti, and G. Santucci. "Visual Exploration and Analysis of the Italian Cybersecurity Framework". In: *Proceedings of the 2018 International Conference on Advanced Visual Interfaces, AVI 2018, Castiglione della Pescaia, Italy, May 29 - June 01, 2018*. 2018, 55:1–55:3. DOI: 10.1145/3206505.3206579.
- Angelini, M., V. Fazzini, N. Ferro, G. Santucci, and G. Silvello. "The CLAIRE Visual Analytics System for Analysing IR Evaluation Data". In: *Proceedings of the 9th Italian Information Retrieval Workshop, Rome, Italy, May, 28-30, 2018*. 2018.
- Angelini, M. and G. Santucci. "ITA.WA.: 1st Italian Visualization & Visual Analytics Workshop". In: *Proceedings of the 2018 International Conference on Advanced Visual Interfaces, AVI 2018, Castiglione della Pescaia, Italy, May 29 - June 01, 2018*. 2018, 10:1–10:3. DOI: 10.1145/3206505.3206601.
- Badea, G., E. Popescu, A. Sterbini, and M. Temperini. "A Service-Oriented Architecture for Student Modeling in Peer Assessment Environments". In: *Proc. 3rd Int. Symp. on Emerging Technologies for Education, SETE 2018*. Vol. 11284. LNCS. Springer, 2018.
- Battle, L., M. Angelini, C. Binnig, T. Catarci, P. Eichmann, J. Fekete, G. Santucci, M. Sedlmair, and W. Willett. "Evaluating Visual Data Analysis Systems: A Discussion Report". In: *Proceedings of the Workshop on Human-In-the-Loop Data Analytics, HILDA@SIGMOD 2018, Houston, TX, USA, June 10, 2018*. 2018, 4:1–4:6. DOI: 10.1145/3209900.3209901.
- Catarci, T., M. Amendola, F. Bertacchini, E. Bilotta, M. Bracalenti, P. Buono, A. Cocco, M. F. Costabile, G. Desolda, F. Di Nocera, S. Federici, G. Gaudino, R. Lanzilotti, A. Marrella, M. L. Mele, P. S. Pantano, I. Poggi, and L. Tarantino. "Digital interaction: Where Are We Going?" In: *Proc. of the 2018 International Conference on Advanced Visual Interfaces, AVI 2018, Castiglione della Pescaia, Italy, May 29 - June 01, 2018*. 2018, 4:1–4:5. DOI: 10.1145/3206505.3206606.
- Condrea, F., L. Cuoco, T.-A. Dincu, E. Popescu, A. Sterbini, and M. Temperini. "Pragmatic Game Authoring Support for an Adaptive Competence-Based Educational System". In: *Proc. 8th Int. Conf. in Methodologies and Intelligent Systems for Technology Enhanced Learning, Mis4TEL 2018*. Vol. 804. Advances in Intelligent Systems and Computing. Springer, 2018, pp. 230–238.

- Di Mascio, T., L. Laura, and M. Temperini. "A Framework for Personalized Competitive Programming Training". In: *Proc. 17th Int. Conf. on Information Technology Based Higher Education and Training, ITHET 2018*. IEEE, 2018.
- Fantozzi, P., L. Laura, U. Nanni, and M. Temperini. "Visual Analysis of Vertex-Disjoint Path Connectivity in Networks". In: *Proc. 22nd Int. Conf. Information Visualisation, IV2018*. 2018.
- Ferro, L. S. and A. Marrella. "VERTO: a Visual Notation for Declarative Process Models". In: *Proc. of the 2018 International Conference on Advanced Visual Interfaces, AVI 2018, Castiglione della Pescaia, Italy, May 29 - June 01, 2018*. 2018, 62:1–62:3. DOI: 10.1145/3206505.3206594.
- Leotta, F., M. Mecella, and D. Sora. "Visual Analysis of Sensor Logs in Smart Spaces: Activities vs. Situations". In: *Fourth IEEE International Conference on Big Data Computing Service and Applications, BigDataService 2018, Bamberg, Germany, March 26-29, 2018*. 2018, pp. 105–114. DOI: 10.1109/BigDataService.2018.00024.
- Marrella, A. and T. Catarci. "Measuring the Learnability of Interactive Systems Using a Petri Net Based Approach". In: *Proc. of the 2018 on Designing Interactive Systems Conference 2018, DIS 2018, Hong Kong, China, June 09-13, 2018*. 2018, pp. 1309–1319. DOI: 10.1145/3196709.3196744.
- Marsico, M. D., F. Sciarrone, A. Sterbini, and M. Temperini. "Peer Assessment and Knowledge Discovering in a Community of Learners". In: *Proc. 10th Int. Conference on Knowledge Discovery and Information Retrieval, KDIR*. 2018.
- Papandrea, S., A. Sterbini, M. Temperini, and E. Popescu. "Q2A-I: A Support Platform for Computer Programming Education, Based on Automated Assessment and Peer Learning". In: *Proc. Int. Conf. on Web-based Learning, ICWL2018*. Vol. 11007. LNCS. Springer, 2018.
- Sapio, F., A. Marrella, and T. Catarci. "Integrating Body Scanning Solutions into Virtual Dressing Rooms". In: *Proc. of the 2018 International Conference on Advanced Visual Interfaces, AVI 2018, Castiglione della Pescaia, Italy, May 29 - June 01, 2018*. 2018, 84:1–84:3. DOI: 10.1145/3206505.3206589.

Articles in Books

- Angelini, M., T. Catarci, M. Mecella, and G. Santucci. "The Visual Side of the Data". In: *A Comprehensive Guide Through the Italian Database Research Over the Last 25 Years*. 2018, pp. 3–25. DOI: 10.1007/978-3-319-61893-7_1.
- Catarci, T. "Visual Interfaces". In: *Encyclopedia of Database Systems, Second Edition*. 2018. DOI: 10.1007/978-1-4614-8265-9_445.
- Catarci, T. "Visual Query Language". In: *Encyclopedia of Database Systems, Second Edition*. 2018. DOI: 10.1007/978-1-4614-8265-9_448.
- Catarci, T., M. Leva, and M. Mecella. "Visual Query Languages for Data Stream". In: *Encyclopedia of Database Systems, Second Edition*. 2018. DOI: 10.1007/978-1-4614-8265-9_80666.
- Catarci, T., M. Mecella, S. Kimani, and G. Santucci. "Visual Query Interfaces". In: *The Wiley Handbook of Human Computer Interaction*. John Wiley & Sons, Ltd, 2017. Chap. 24, pp. 561–577. DOI: 10.1002/9781118976005.ch24.

- Chevalier, F., M. Tory, B. Lee, J. van Wijk, G. Santucci, M. Dörk, and J. Hullman. "From Analysis to Communication: Supporting the Lifecycle of a Story". In: *Data-Driven Storytelling*. AK Peters/CRC Press, 2018, pp. 169–202.
- Di Mascio, T., P. Vittorini, R. Gennari, F. De la Prieta, S. Rodriguez, M. Temperini, R. A. Silveira, E. Popescu, and L. L. (Eds.) *Proc. 8th Int. Conference Methodologies and Intelligent Systems for Technology Enhanced Learning, Mis4TEL 2018*. Vol. 804. Advances in Intelligent Systems and Computing AISC. Springer, 2018.
- Liu, L. and M. T. Özsu, eds. *Encyclopedia of Database Systems, Second Edition*. Springer, 2018. DOI: 10.1007/978-1-4614-8265-9.
- Marsico, M. D., F. Sciarrone, A. Sterbini, and M. Temperini. "Educational Data Mining for Peer Assessment in Communities of Learners". In: *The Future of Innovation and Technology in Education: Policies and Practices for Teaching and Learning Excellence*. Ed. by A. Visvizi, M. Lytras, and L. Daniela. Emerald, 2018.
- Polito, G. and M. Temperini. "A Gamified Approach to Automated Assessment of Programming Assignments". In: *Challenges and Solutions in Smart Learning. Proceedings Int. Conference on Smart Learning Environment, ICSLE 2018*. Lecture Notes in Educational Technology. Springer, 2018, pp. 3–12.
- Santucci, G. "Mobile Interfaces". In: *Encyclopedia of Database Systems, Second Edition*. 2018. DOI: 10.1007/978-1-4614-8265-9_219.

Other (Books, Technical Reports, Submitted Papers, etc.)

- Banissi, E., R. Francese, M. W. M. Bannatyne, T. G. Wyeld, M. Sarfraz, J. M. Pires, A. Ursyn, F. Bouali, N. S. Datia, G. Venturini, T. Di Mascio, M. Temperini, F. Sciarrone, D. Malandrino, R. Zaccagnino, P. Diaz, F. Papadopoulo, A. F. Anta, A. Cuzzocrea, M. Risi, U. Erra, and V. R. (Eds.) "Proceedings 22nd Int. Conf. Information Visualisation, IV2018, Information Visualisation - Biomedical Visualization, Visualisation on Built and Rural Environments & Geometric Modelling and Imaging". 2018.
- Catarci, T., K. L. Norman, and M. Mecella, eds. *Proceedings of the 2018 International Conference on Advanced Visual Interfaces, AVI 2018, Castiglione della Pescaia, Italy, May 29 - June 01, 2018*. ACM, 2018. DOI: 10.1145/3206505.
- Di Mascio, T., P. Vittorini, R. Gennari, F. De la Prieta, S. Rodriguez, M. Temperini, R. A. Silveira, E. Popescu, and L. L. (Eds.) *Proc. 8th Int. Conference Methodologies and Intelligent Systems for Technology Enhanced Learning, Mis4TEL 2018*. Vol. 804. Advances in Intelligent Systems and Computing AISC. Springer, 2018.
- Liu, L. and M. T. Özsu, eds. *Encyclopedia of Database Systems, Second Edition*. Springer, 2018. DOI: 10.1007/978-1-4614-8265-9.
- Maggi, F. M., A. Marrella, F. Milani, A. Soo, and S. Kasela. "A User Evaluation of Automated Process Discovery Algorithms". *CoRR abs/1806.03150*. 2018.

Management Engineering

Industrial Organization and Management

Journal Papers

- Agasisti, T., G. Catalano, and A. Erbacci. "How Resistance to Change Affects the Implementation of Accrual Accounting in Italian Public Universities: a Comparative Case Study". In: *International Journal of Public Administration* 41(12).NA (2018), pp. 946–956. DOI: 10.1080/01900692.2017.1301469.
- Annarelli, A., C. Battistella, Y. Borgianni, and F. Nonino. "Estimating the Value of Servitization: A Non-Monetary Method Based on Forecasted Competitive Advantage". In: *Journal of Cleaner Production* 200.NA (2018), pp. 74–85. DOI: 10.1016/j.jclepro.2018.07.220.
- Armenia, S., E. F. Franco, F. Nonino, E. Spagnoli, and C. M. Medaglia. "Towards the Definition of a Dynamic and Systemic Assessment for Cybersecurity Risks". In: *Systems Research and Behavioral Science* (2018). DOI: 10.1002/sres.2556.
- Armenia, S., A. Pompei, V. Pupillo, and F. Nonino. "Marketing Competition on a New Product Introduction – a Structural Analysis Using Systems Thinking". In: *International Journal of Markets and Business Systems* 3.2 (2018), pp. 141–162. DOI: 10.1504/IJMABS.2018.090513.
- Avenali, A., A. Boitani, G. Catalano, and T. D. G. Matteucci. "Assessing Standard Costs in Local Public Bus Transport: a Hybrid Cost Model". In: *Transport Policy* 62.1 (2018), pp. 48–57. DOI: 10.1016/j.tranpol.2017.03.011.
- Avenali, A., V. Bracaglia, T. D'Alfonso, and P. Reverberi. "Strategic Formation and Welfare Effects of Airline-High Speed Rail Agreements". In: *Transportation Research Part B: Methodological* 117.A (2018), pp. 193–411. DOI: 10.1016/j.trb.2018.09.002.
- Chen, C., T. D'Alfonso, H. Guo, and C. Jiang. "Analysis of the Chinese High-Speed Rail Network Over Time". In: *Research in Transportation Economics* 72.1 (2018), pp. 3–14. DOI: 10.1016/j.retrec.2018.07.030.
- Daraio, C., F. Fabbri, G. Gavazzi, M. G. Izzo, L. Leuzzi, G. Quaglia, and G. Ruocco. "Assessing the Interdependencies Between Scientific Disciplinary Profiles". In: *Scientometrics* 116.3 (2018), pp. 1785–1803. DOI: 10.1007/s11192-018-2816-5.
- Daraio, C., L. Simar, and P. W. Wilson. "Central Limit Theorems for Conditional Efficiency Measures and Tests of the "Separability" Condition in Nonparametric, Two-Stage Models of Production". In: *The Econometrics Journal* 21.1 (2018), pp. 170–191. DOI: 10.1111/ectj.12103.
- Dehghani, M. and R. M. Dangelico. "Smart Wearable Technologies: Current Status and Future Directions Through a Patent Analysis". In: *International Journal of Product Development* 22.4 (2018), pp. 293–313. DOI: 10.1504/IJPD.2018.091148.
- Dehghani, M., K. J. Kim, and R. M. Dangelico. "Will Smartwatches Last? Factors Contributing to Intention to Keep Using Smart Wearable Technology". In: *Telematics and Informatics* 35.2 (2018), pp. 480–490. DOI: 10.1016/j.tele.2018.01.007.

- Fraccascia, L. "Industrial Symbiosis and Urban Areas: a Systematic Review and Future Research Directions". In: *Procedia Environmental Science, Engineering and Management* 5.2 (2018), pp. 73–83. DOI: --.
- Fraccascia, L. and D. M. Yazan. "The Supply Chain Implications of Industrial Symbiosis". In: *Procedia Environmental Science, Engineering and Management* 5.2 (2018), pp. 61–72. DOI: --.
- Garrone, P., L. Grilli, A. Groppi, and R. Marzano. "Barriers and Drivers in the Adoption of Advanced Wastewater Treatment Technologies: A Comparative Analysis of Italian Utilities". In: *Journal of Cleaner Production* 171.Supplement (2018), S69–S78. DOI: doi.org/10.1016/j.jclepro.2016.02.018.
- Iazzolino, G. and D. Laise. "Knowledge Worker Productivity: Is It Really Impossible to Measure It?" In: *Measuring Business Excellence* 22.4 (2018), pp. 346–361. DOI: 10.1108/MBE-06-2018-0035.
- Lorenzo, A. and R. M. Dangelico. "Firm Environmental Performance Under Scrutiny: The Role of Strategic and Organizational Orientations". In: *Corporate Social Responsibility and Environmental Management* 25.4 (2018), pp. 426–440. DOI: 10.1002/csr.1470.
- Marzano, R., C. Rougé, P. Garrone, L. Grilli, J. J. Harou, and M. Pulido-Velazquez. "Determinants of the Price Response to Residential Water Tariffs: Meta-Analysis and Beyond". In: *Environmental Modelling & Software* 101.1 (2018), pp. 236–248. DOI: doi.org/10.1016/j.envsoft.2017.12.017.
- Matteucci, G. and P. Reverberi. "Uniform Pricing and Product Innovation". In: *B.E. Journal of Theoretical Economics* 18.1 (2018), pp. -. DOI: 10.1515/bejte-2016-0110.
- Rougé, C., J. J. Harou, M. Pulido-Velazquez, E. S. Matrosov, P. Garrone, R. Marzano, A. Lopez-Nicolas, A. Castelletti, and A.-E. Rizzoli. "Assessment of Smart-Meter-Enabled Dynamic Pricing at Utility and River Basin Scale". In: *Journal of Water Resources Planning and Management* 144.5 (2018). DOI: doi/abs/10.1061/(ASCE)WR.1943-5452.0000888.

Conference Proceedings

- Annarelli, A., C. Battistella, F. Nonino, and G. Palombi. "The Evolution and Influence of Project Management Theory and Practices: A Process Network Analysis". In: *Proceedings of 25th European Operations Management Association (EurOMA) Conference*. 2018.
- Annarelli, A., C. Battistella, F. Nonino, and G. Palombi. "Unveiling the Complexity of PMBOK Through Process Network Analysis". In: *Book of abstracts of 3rd Project Management Institute Italian Academic Workshop*. 2018.
- Annarelli, A., C. Battistella, F. Nonino, and E. Pessot. "Investigating the What and the How of Digitalization Capabilities". In: *Atti XXIX Riunione Scientifica Annuale Associazione italiana Ingegneria Gestionale*. 2018.
- Armenia, S., H. Carvalho, E. F. Franco, C. M. Medaglia, F. Nonino, A. Pompei, and J. R. dos Santos. "Understanding the Root Causes of Water Scarcity Through System Dynamics: the Italian Case of the Bracciano Lake". In: *Book of Abstracts of the 5th Business Systems Laboratory International Symposium*. 2018.

- Battistella, C., R. M. Dangelico, F. Nonino, and E. Pessot. "Falling Stars When Doing Social: Case Studies of Social Start-ups". In: *Proceedings of 25th Innovation and Product Development Management Conference*. 2018.
- Battistella, C., R. M. Dangelico, F. Nonino, and E. Pessot. "Falling Stars When Doing Social: Case Studies of Social start-ups". In: *Proceedings of the EIASM 25th Innovation and Product Development Management Conference (IPDMC)*. 2018.
- Borgatti, S. P., F. Nonino, and G. Palombi. "The Impact of Informal Social Network Structures and Irrational Behavior on Small Groups' Performances". In: *Proceedings of XXXVIII International Sunbelt Social Network Analysis Conference - INSNA*. 2018.
- Borgatti, S. P., F. Nonino, and G. Palombi. "The Impact of Social Relationships and Incentives on Small Groups' Knowledge Sharing Dynamics". In: *Proceedings of 13th International Forum on Knowledge Asset Dynamic*. 2018.
- Daraio, C., M. Gregori, G. Catalano, and H. Moed. "Tackling the Heterogeneity of HEIs by Combining Different Data Sources and Applying Advanced Conditional Benchmarking Techniques". In: *STI 2018 Conference Proceedings. 23rd International Conference on Science and Technology Indicators, September 12-14, 2018, Leiden, The Netherlands*. 2018.
- Forzoni, L., C. Buffagni, F. Nonino, and A. Pompei. "Case Study of a Clinical Marketing Strategy Within a Global Diagnostic Imaging Company". In: *Proceedings of the 2018 International Conference on Education Technology Management*. 2018.
- Niaki, M. K., F. Nonino, and G. Palombi. "Project Value: A Literature Review". In: *Proceedings of 25th European Operations Management Association (EurOMA) Conference*. 2018.
- Nonino, F. and G. Palombi. "How to Estimate Project Value? A Literature Review and a Multidimensional Index Proposal". In: *Book of abstracts of 3rd Project Management Institute Italian Academic Workshop*. 2018.
- Nonino, F. and G. Palombi. "Project Management's University Educational Offering: A Comparative Analysis Between Italy, United Kingdom and United States". In: *Proceedings of 25th European Operations Management Association (EurOMA) Conference*. 2018.
- Nonino, F. and A. Pompei. "How to Address the Uncertainty Complexity: a New Method for the Contingency Reserve Calculation". In: *Book of abstracts of 3rd Project Management Institute Italian Academic Workshop*. 2018.

Articles in Books

- Catalano, G. "La Mobilità Sostenibile e il Nuovo Trasporto Pubblico Locale. In Connettere l'Italia. Trasporti e Logistica per un Paese che Cambia". In: Franco Angeli, 2018. DOI: n.a..
- Daraio, C. "Nonparametric Methods and Higher Education, in: Teixeira P., Shin J. (eds) Encyclopedia of International Higher Education Systems and Institutions." In: Springer, Dordrecht, 2018. DOI: 10.1007/978-94-017-9553-1_82-1.

Other (Books, Technical Reports, Submitted Papers, etc.)

- Niaki, M. K. and F. Nonino. "The Management of Additive Manufacturing – Enhancing Business Value". Springer International Publishing. 2018.

Operations Research

Combinatorial Optimization

Journal Papers

- Baruah, S., V. Bonifaci, R. Bruni, and A. Marchetti-Spaccamela. "ILP Models for the Allocation of Recurrent Workloads Upon Heterogeneous Multiprocessors". In: *Journal of Scheduling* (2018). Online. DOI: 10.1007/s10951-018-0593-x.
- Bianchi, G., R. Bruni, and F. Scalfati. "Identifying e-Commerce in Enterprises by Means of Text Mining and Classification Algorithms". In: *Mathematical Problems in Engineering* 2018.7231920 (2018). Online. DOI: 10.1155/2018/7231920.
- Bruni, R., G. Bianchi, C. Dolente, and C. Leporelli. "Logical Analysis of Data as a Tool for the Analysis of Probabilistic Discrete Choice Behavior". In: *Computers and Operations Research* (2018). Online. DOI: 10.1016/j.cor.2018.04.014.
- Detti, P., G. Z. M. de Lara, R. Bruni, M. Pranzo, F. Sarnari, and G. Vatti. "A Patient-Specific Approach for Short-Term Epileptic Seizures Prediction Through the Analysis of EEG Synchronization". In: *IEEE Transactions on Biomedical Engineering* (2018). Online. DOI: 10.1109/TBME.2018.2874716.

Other (Books, Technical Reports, Submitted Papers, etc.)

- Bruni, R. and F. Celani. "Combining Global and Local Strategies to Optimize Parameters in Magnetic Spacecraft Control via Attitude Feedback". Submitted to *Journal of Optimization Theory and Applications*. 2018.

Continuous Optimization

Journal Papers

- Buchheim, C., M. De Santis, F. Rinaldi, and L. Trieu. "A Frank–Wolfe Based Branch–and–Bound Algorithm for Mean–Risk Optimization". In: *Journal of Global Optimization* 70.3 (2018), pp. 625–644. DOI: 10.1007/s10898-017-0571-4.
- Caliciotti, A., G. Fasano, S. G. Nash, and M. Roma. "An Adaptive Truncation Criterion for Linesearch–Based Truncated Newton Methods in Large Scale Nonconvex Optimization". In: *Operations Research Letters* 46.1 (2018), pp. 7–12. DOI: 10.1016/j.orl.2017.10.014.
- Caliciotti, A., G. Fasano, S. G. Nash, and M. Roma. "Data and Performance Profiles Applying an Adaptive Truncation Criterion, within Linesearch-Based Truncated Newton Methods, in Large Scale Nonconvex Optimization". In: *Data in Brief* 17 (2018), pp. 246–255. DOI: 10.1016/j.dib.2018.01.012.
- Caliciotti, A., G. Fasano, and M. Roma. "Preconditioned Nonlinear Conjugate Gradient Methods Based on a Modified Secant Equation". In: *Applied Mathematics and Computation* 318 (2018), pp. 196–214. DOI: 10.1016/j.amc.2017.08.029.
- Campana, E. F., M. Diez, G. Liuzzi, S. Lucidi, R. Pellegrini, V. Piccialli, F. Rinaldi, and A. Serani. "A Multi-Objective DIRECT Algorithm for Ship Hull Optimization". In: *Computational Optimization and Applications* 71 (2018), pp. 53–72. DOI: 10.1007/s10589-017-9955-0.

- Cesarone, F., L. Lampariello, and S. Sagratella. "A Risk–Gain Dominance Maximization Approach to Enhanced Index Tracking". In: *Finance Research Letters* (2018). Online. DOI: 10.1016/j.frl.2018.08.001.
- Cristofari, A., M. De Santis, S. Lucidi, and F. Rinaldi. "Data and Performance of an Active–Set Truncated Newton Method with Non–Monotone Line Search for Bound–Constrained Optimization". In: *Data in brief* 21 (2018), pp. 2155–2169. DOI: 10.1016/j.dib.2018.11.061.
- Cristofari, A., N. T. Dehghan, and S. Lucidi. "On Global Minimizers of Quadratic Functions with Cubic Regularization". In: *Optimization Letters* (2018). Online. DOI: 10.1007/s11590-018-1316-0.
- De Santis, M., F. Rendl, and A. Wiegele. "Using a Factored Dual in Augmented Lagrangian Methods for Semidefinite Programming". In: *Operations Research Letters* 46.5 (2018), pp. 523–528. DOI: 10.1016/j.orl.2018.08.003.
- Facchinei, F. and J.-S. Pang. "Multi-agent Optimization Cetraro, Italy 2014 Preface". In: *Lecture Notes in Mathematics* 2224 (2018), pp. v–vi.
- Lamedica, R., E. Santini, A. Ruvio, L. Palagi, and I. Rossetta. "A MILP Methodology to Optimize PV – Wind Renewable Energy Systems Sizing". In: *Energy* 165 (2018), pp. 385–398. DOI: 10.1016/j.energy.2018.09.087.
- Latorre, V., H. Habal, H. Graeb, and S. Lucidi. "Derivative Free Methodologies for Circuit Worst Case Analysis". In: *Optimization Letters* (2018). DOI: 10.1007/s11590-018-1364-5.
- Manno, A., L. Palagi, and S. Sagratella. "Parallel Decomposition Methods for Linearly Constrained Problems Subject to Simple Bound with Application to the SVMs Training". In: *Computational Optimization and Applications* 71.1 (2018), pp. 115–145. DOI: 10.1007/s10589-018-9987-0.
- Palagi, L. "Global Optimization Issues in Deep Network Regression: an Overview". In: *Journal of Global Optimization* (2018), pp. 1–39. DOI: 10.1007/s10898-018-0701-7.
- Palagi, L., A. Pesyridis, E. Sciubba, and L. Tocci. "Machine Learning for the Prediction of the Dynamic Behavior of a Small Scale ORC System". In: *Energy* 166 (2018), pp. 72–82. DOI: 10.1016/j.energy.2018.10.059.

Conference Proceedings

- Al-Baali, M., A. Caliciotti, G. Fasano, and M. Roma. "Quasi–Newton Based Preconditioning and Damped Quasi–Newton Schemes for Nonlinear Conjugate Gradient Methods". In: *Numerical Analysis and Optimization*. Vol. 235. 2018, pp. 1–21. DOI: 10.1007/978-3-319-90026-1_1.
- Cannelli, L., F. Facchinei, and G. Scutari. "Multi-Agent Asynchronous Nonconvex Large-Scale Optimization". In: *Proc. of 2017 IEEE 7th International Workshop on Computational Advances in Multi-Sensor Adaptive Processing, CAMSAP 2017*. 2018, pp. 1–5. DOI: 10.1109/CAMSAP.2017.8313161.
- Lucidi, S. and L. Maccarrone. "A New Grey–Box Approach to Solve Challenging Workforce Planning and Activities Scheduling Problems". In: *Proc. of 16th International Conference on Project Management and Scheduling. Rome, April 17-20, 2018*. 2018, pp. 141–144.

Pellegrini, R., A. Serani, G. Liuzzi, F. Rinaldi, S. Lucidi, E. F. Campana, U. Iemma, and M. Diez. "Hybrid Global/Local Derivative-Free Multi-Objective Optimization Via Deterministic Particle Swarm with Local Linesearch". In: *Proc. of Machine Learning, Optimization, and Big Data Third International Conference, MOD 2017 Volterra, Italy, September 14-17, 2017 Revised Selected Papers*. 2018, pp. 198–209.

Other (Books, Technical Reports, Submitted Papers, etc.)

- Bernabei, G., F. Costantino, L. Palagi, R. Patriarca, and F. Romito. "An Integer Black-Box Optimization Model for Repairable Spare Parts Management in Multi-Item Systems". Submitted to *Computers and Operations Research*. 2018.
- Cannelli, L., F. Facchinei, G. Scutari, and V. Kungurtsev. "Asynchronous Optimization over Graphs: Linear Convergence under Error Bound Conditions". Submitted to *IEEE Transaction on Automatic Control*. 2018.
- Conforti, M., M. De Santis, M. D. Summa, and F. Rinaldi. "Scanning Integer Points with Lex-Cuts: a Finite Cutting Plane Algorithm for Integer Programming with Linear Objective". Submitted to *SIAM Journal on Optimization*. 2018.
- Cristofari, A., M. De Santis, S. Lucidi, and F. Rinaldi. "An Active-Set Algorithmic Framework for Non-Convex Optimization Problems over the Simplex". Submitted to *Computational Optimization and Applications*. 2018.
- Daneshmand, A., Y. Sun, G. Scutari, F. Facchinei, and B. M. Sadler. "Decentralized Dictionary Learning Over Time-Varying Digraphs". Submitted to *Journal of Machine Learning Research*. 2018.
- De Santis, M., G. Grani, and L. Palagi. "The Frontier Partitioner Algorithm: a Branch and Cut Algorithm for Biobjective Integer Programming". Submitted to *European Journal of Operational Research*. 2018.
- Facchinei, F. and J.-S. Pang (Eds.) "Multi-Agent Optimization". Lecture Notes in Mathematics 2224, Springer. 2018.
- Grani, G., G. Leo, L. Palagi, and M. Piacentini. "Revenue Management: a Market-Service Decomposition Approach for the Sales Based Integer Program Model". Submitted to *Transportation Science*. 2018.
- Palagi, L. and R. Seccia. "Online Block Layer Decomposition Schemes for Training Deep Neural Networks". Submitted to *Journal of Global Optimization*. 2018.

Systems and Control Engineering

Networked Systems

Journal Papers

- Adamsky, F., M. Aubigny, F. Battisti, M. Carli, F. Cimorelli, T. Cruz, A. Di Giorgio, C. Foglietta, A. Galli, A. Giuseppi, F. Liberati, A. Neri, S. Panzieri, F. Pascucci, J. Proenca, P. Pucci, L. Rosa, and R. Soua. "Integrated Protection of Industrial Control Systems from Cyber-Attacks: the ATENA approach". In: *International Journal of Critical Infrastructure Protection* 21 (2018), pp. 72–82. DOI: 10.1016/j.ijcip.2018.04.004.
- Casadei, G., A. Isidori, and L. Marconi. "About Disconnected Topologies and Synchronization of Homogeneous Nonlinear Agents over Switching Networks". In: *International Journal of Robust and Nonlinear Control* 28.3 (2018), pp. 901–917. DOI: 10.1002/rnc.3910.
- Conforto, P., F. Delli Priscoli, A. Di Giorgio, and L. Ricciardi Celsi. "A Game Theoretic Model and a Distributed Admission Control Scheme for Quality of Service Routing". In: *International Journal of Systems, Control and Communications* 9.4 (2018), pp. 338–368. DOI: 10.1504/IJSCC.2018.095269.
- Di Giorgio, A., A. Pietrabissa, F. Delli Priscoli, and A. Isidori. "An Extended-Observer Approach to Robust Stabilisation of Linear Differential-Algebraic Systems". In: *International Journal of Control* (2018). DOI: 10.1080/00207179.2018.1540882.
- Di Giorgio, A., A. Pietrabissa, F. Delli Priscoli, and A. Isidori. "Robust Output Regulation for a Class of Linear Differential-Algebraic Systems". In: *IEEE Control Systems Letters* 2.3 (2018), pp. 477–482. DOI: 10.1109/LCSYS.2018.2841805.
- Di Giorgio, A., A. Pietrabissa, F. Delli Priscoli, and A. Isidori. "Robust Protection Scheme Against Cyberphysical Attacks in Power Systems". In: *IET Control Theory and Applications* 12.13 (2018), pp. 1792–1801. DOI: 10.1049/iet-cta.2017.0725.
- Liberati, F. and A. Di Giorgio. "Economic Model Predictive and Feedback Control of a Smart Grid Prosumer Node". In: *Energies* 11.1 (2018). DOI: 10.3390/en11010048.
- Pietrabissa, A., A. Di Giorgio, G. Oddi, G. Chini, M. L. Chiang, and C. Poli. "Cooperative Receding Horizon Strategies for the Multivehicle Routing Problem". In: *Optimal Control Applications and Methods* 39.1 (2018), pp. 248–262. DOI: 10.1002/oca.2345.
- Pietrabissa, A., L. Ricciardi Celsi, F. Cimorelli, V. Suraci, F. Delli Priscoli, A. Di Giorgio, A. Giuseppi, and S. Monaco. "Lyapunov-Based Design of a Distributed Wardrop Load-Balancing Algorithm With Application to Software-Defined Networking". In: *IEEE Transactions on Control Systems Technology* (2018). DOI: 10.1109/TCST.2018.2842044.

Conference Proceedings

- Giuseppi, A., R. Germaná, and A. Di Giorgio. "Risk Adverse Virtual Power Plant Control in Unsecure Power Systems". In: *Proc. of 26th Mediterranean Conference on Control and Automation (MED 2018)*. 2018, pp. 210–216. DOI: 10.1109/MED.2018.8442768.
- Martirano, L., E. Habib, A. Giuseppi, and A. Di Giorgio. "Nearly Zero Energy Building Model Predictive Control for Efficient Heating". In: *Proc. of 2018 IEEE Industry Applications Society Annual Meeting (IAS 2018)*. 2018. DOI: 10.1109/IAS.2018.8544632.

- Panfili, M., A. Giuseppi, A. Fiaschetti, H. B. Al-Jibreen, A. Pietrabissa, and F. Delli Priscoli. "A Game-Theoretical Approach to Cyber-Security of Critical Infrastructures Based on Multi-Agent Reinforcement Learning". In: *Proc. of 26th Mediterranean Conference on Control and Automation (MED 2018)*. 2018, pp. 460–465. DOI: 10.1109/MED.2018.8442695.
- Pyrkin, A. A. and A. Isidori. "Output Regulation for Robustly Minimum-Phase Multivariable Nonlinear Systems". In: *2017 IEEE 56th Annual Conference on Decision and Control, CDC 2017*. 2018, pp. 873–878. DOI: 10.1109/CDC.2017.8263769.
- Suraci, V., L. R. Celsi, A. Giuseppi, G. Manfredi, and A. Di Giorgio. "Distributed Wardrop Load Balancing in Multi-MTU SCADA Systems". In: *Proc. of 26th Mediterranean Conference on Control and Automation (MED 2018)*. 2018, pp. 466–472. DOI: 10.1109/MED.2018.8442485.

Other (Books, Technical Reports, Submitted Papers, etc.)

- Giuseppi, A., A. Pietrabissa, S. Cilione, and L. Galvagni. "Feedback Linearization-Based Satellite Attitude Control with a Life-Support Device without Communications". Submitted to *Control Engineering Practice*. 2018.

Nonlinear Systems and Control

Journal Papers

- Battilotti, S., F. Cacace, M. D'Angelo, and A. Germani. "Distributed Kalman Filtering over Sensor Network with Unknown Random Link". In: *IEEE Control Systems Letters 2* (2018), pp. 587–592. DOI: 10.1109/LCSYS.2018.2845304.
- Benvenuti, L. "The NIEP for Four Dimensional Leslie and Doubly Stochastic Matrices with Zero Trace from the Coefficients of the Characteristic Polynomial". In: *Linear Algebra and its Applications 544* (2018), pp. 286–298. DOI: 10.1016/j.laa.2018.01.016.
- Califano, C., E. Scharbarg, N. Magdelaine, and C. H. Moog. "Diabetic Gastroparesis Modeling and Observer Design". In: *IFAC-PapersOnLine 51.13* (2018), pp. 97–102. DOI: 10.1016/j.ifacol.2018.07.261.
- Casadei, G., A. Isidori, and L. Marconi. "About Disconnected Topologies and Synchronization of Homogeneous Nonlinear Agents over Switching Networks". In: *International Journal of Robust and Nonlinear Control 28.3* (2018), pp. 901–917. DOI: 10.1002/rnc.3910.
- Di Giamberardino, P., M. Aceto, O. Giannini, and M. Verotti. "Recursive Least Squares Filtering Algorithms for On-Line Viscoelastic Characterization of Biosamples". In: *Actuators 7.4* (2018). DOI: 10.3390/act7040074.
- Di Giamberardino, P. and D. Iacoviello. "HIV Infection Control: A Constructive Algorithm for a State-based Switching Control". In: *International Journal of Control, Automation and Systems 16.3* (2018), pp. 1469–1469. DOI: 10.1007/s12555-017-0211-2.
- Di Giamberardino, P. and D. Iacoviello. "LQ Control Design for the Containment of the HIV/AIDS Diffusion". In: *Control Engineering Practice 77* (2018), pp. 162–173. DOI: 10.1016/j.conengprac.2018.05.011.

- Mattioni, M., M. Hassan, S. Monaco, and D. Normand-Cyrot. "On Partially Minimum-Phase Systems and Disturbance Decoupling with Stability". In: *Nonlinear Dynamics* (2019). To appear in *Nonlinear Dynamics*. DOI: 10.1007/s11071-019-04999-3.
- Mattioni, M., S. Monaco, and D. Normand-Cyrot. "Reduction of Discrete-Time Two-Channel Delayed Systems". In: *IEEE Control Systems Letters* 2.3 (2018), pp. 339–344. DOI: 10.1109/LCSYS.2018.2837881.
- Pietrabissa, A., L. R. Celsi, F. Cimorelli, V. Suraci, F. Delli Priscoli, A. Di Giorgio, A. Giuseppe, and S. Monaco. "Lyapunov-Based Design of a Distributed Wardrop Load-Balancing Algorithm With Application to Software-Defined Networking". In: *IEEE Transactions on Control Systems Technology* (2018). DOI: 10.1109/TCST.2018.2842044.
- Placidi, G., M. Polsinelli, M. Spezialetti, L. Cinque, P. Di Giamberardino, and D. Iacoviello. "Self-Induced Emotions as Alternative Paradigm for Driving Brain-Computer Interfaces". In: *Computer Methods in Biomechanics and Biomedical Engineering: Imaging & Visualization* (2018), pp. 1–8. DOI: 10.1080/21681163.2018.1479312.

Conference Proceedings

- Battilotti, S., F. Cacace, M. D'Angelo, and A. Germani. "Cooperative Filtering with Absolute and Relative Measurements". In: *Proc. of IEEE Conference on Decision and Control*. 2018.
- Battilotti, S., F. Cacace, M. D'Angelo, and A. Germani. "Distributed Kalman Filtering over Sensor Networks with Unknown Random Link Failures". In: *Proc. of IEEE Conference on Decision and Control*. 2018.
- Califano, C. and C. H. Moog. "T-Accessibility for a Class of Nonlinear Time-Delay Systems". In: *Proc. of 2018 Annual American Control Conference (ACC)*. IEEE. 2018, pp. 3310–3315.
- Di Giamberardino, P., M. Aceto, O. Giannini, and M. Verotti. "Dynamic Estimation of Visco-elastic Mechanical Characteristics of Biological Samples under Micro Manipulation". In: *Proc. of the 15th Int. Conf. on Informatics in Control, Automation and Robotics (ICINCO 2018)*. Winner of the Best Short Paper/Poster Award. 2018, pp. 503–510. DOI: 10.5220/0006914405130520.
- Di Giamberardino, P. and D. Iacoviello. "Optimal Control with Singular Solution for SIR Epidemic Systems". In: *Proc. of 26th Mediterranean Conference on Control and Automation (MED 2018)*. 2018, pp. 909–914. DOI: 10.1109/MED.2018.8442937.
- Gennari, F. and C. Califano. "T-Accessibility for Nonlinear Time-Delay Systems: the General Case". In: *Proc. of 2018 IEEE Conference on Decision and Control (CDC)*. IEEE. 2018, pp. 2950–2955.
- Mattioni, M., S. Monaco, and D. Normand-Cyrot. "Reduction-Based Stabilization of Time-Delay Systems". In: *Proc. of 2018 IEEE 57th Annual Conference on Decision and Control (CDC)*. 2018, pp. 3471–3476.
- Pyrkin, A. A. and A. Isidori. "Output Regulation for Robustly Minimum-Phase Multivariable Nonlinear Systems". In: *2017 IEEE 56th Annual Conference on Decision and Control, CDC 2017*. 2018, pp. 873–878. DOI: 10.1109/CDC.2017.8263769.

Articles in Books

- Bagolini, A., P. Bellutti, P. Di Giamberardino, I. Rudas, V. D'Andrea, M. Verotti, A. Dochshyanov, and N. Belfiore. "Stiffness Characterization of Biological Tissues by Means of MEMS–Technology Based Micro Grippers Under Position Control". In: *Advances in Service and Industrial Robotics. RAAD 2017. Mechanisms and Machine Science*. Ed. by Q. G. Ferraresi C. Springer, Cham, 2018, pp. 939–947. DOI: 10.1007/978-3-319-61276-8_100.
- Di Giamberardino, P., D. Iacoviello, G. Placidi, M. Polsinelli, and M. Spezialetti. "A Brain Computer Interface by EEG Signals from Self–Induced Emotions". In: *Lecture Notes in Computational Vision and Biomechanics*. Ed. by N. J. R. Tavares J. Vol. 27. Springer, Cham, 2018, pp. 713–721. DOI: 10.1007/978-3-319-68195-5_77.
- Ferrante, O., A. Ferrari, C. Sofronis, L. Mangeruca, and L. Benvenuti. "An Application of Parallel Satisfiability Solving to the Verification of Complex Embedded Systems". In: *Handbook of Parallel Constraint Reasoning*. Ed. by Y. Hamadi and L. Sais. Springer, Cham, 2018, pp. 617–632. DOI: 10.1007/978-3-319-63516-3_16.

Other (Books, Technical Reports, Submitted Papers, etc.)

- Battilotti, S. "Continuous and Sampled–Data Stabilizers for Nonlinear Systems with Input and Measurement Delays". To appear in *IEEE Transactions on Automatic Control*. 2019.
- Battilotti, S. "Multilayer State Predictors for Nonlinear Nystems with Time–Varying Measurement Delays". To appear in *SIAM Journal of Control and Optimization*. 2019.
- Battilotti, S., F. Cacace, M. D'Angelo, and A. Germani. "The Polynomial Approach to the LQ Non–Gaussian Regulator Problem through Output Injection". To appear in *IEEE Transactions on Automatic Control*. 2019.
- Battilotti, S., F. Cacace, A. Germani, and B. Sinopoli. "LQ non–Gaussian Regulator with Markovian Control". To appear in *IEEE Control Systems Letters*. 2019.
- Battilotti, S. and C. Califano. "Leader–Following Consensus for Nonlinear Agents with Measurement Feedback". To appear in *Journal of Robust and Nonlinear Control*. 2019.
- Battilotti, S. and M. D'Angelo. "Delay–State Dynamics to Filtering Gaussian Systems with Markovian Delayed Measurements". To appear in *Proc. of European Control Conference*. 2019.
- Califano, C., H. Ito, and C. Prieur. "A Glimpse on Recent Education Activities in the Nonlinear Control Field". To appear in *Proc. of IFAC-ACE, Invited Paper*. 2019.
- Califano, C., E. Scharbarg, N. Magdelaine, and C. H. Moog. "A Nonlinear Time-Delay Realization for Gastroparesis in Patients with Diabetes". Submitted to *Annual Reviews in Control*. 2019.
- Di Giamberardino, P. "Dynamic extension for direct integrability of singular solutions in optimal control problems". To appear in *Proc. of the 17th European Control Conference 2019 (ECC 2019)*. 2019.
- Di Giamberardino, P., A. Bagolini, P. Bellutti, I. Rudas, M. Verotti, F. Botta, and N. P. Belfiore. "New MEMS Tweezers for the Viscoelastic Characterization of Soft Materials at the Microscale". Submitted to *Micromachines*.

- Di Giamberardino, P. and D. Iacoviello. "A linear quadratic regulator for nonlinear SIRC epidemic model". To appear in *Proc. of 22nd International Conference on System Theory, Control and Computing (ICSTCC 2019)*. 2019.
- Di Giamberardino, P. and D. Iacoviello. "A State Dependent Approach to Resource Allocation Strategies". To appear in *Informatics in Control, Automation and Robotics. ICINCO 2017. Lecture Notes in Electrical Engineering*. 2020.
- Di Giamberardino, P. and D. Iacoviello. "An Improvement in a Local Observer Design for Optimal State Feedback Control: the Case Study of HIV/AIDS Diffusion". To appear in *Proc. of the 16th Int. Conf. on Informatics in Control, Automation and Robotics (ICINCO 2019)*. 2019.
- Di Giamberardino, P. and D. Iacoviello. "An optimal control approach to public investments for unemployment reduction". To appear in *Proc. of 22nd International Conference on System Theory, Control and Computing (ICSTCC 2019)*. 2019.
- Di Giamberardino, P. and D. Iacoviello. "Analysis, simulation and control of a new measles epidemic model". To appear in *Proc. of the 16th Int. Conf. on Informatics in Control, Automation and Robotics (ICINCO 2019)*. 2019.
- Di Giamberardino, P. and D. Iacoviello. "Epidemic modelling and control of HIV/AIDS dynamics in populations under external interactions : a worldwide challenge". To appear in *Control applications for Biomedical Engineering Systems*. 2019.
- Di Giamberardino, P. and D. Iacoviello. "Modeling and control of measles epidemic spread with immunodepressed individuals and possible complications". To appear in the *Proc. of the 58th IEEE Conference on Decision and Control (CDC)*. 2019.
- Di Giamberardino, P. and D. Iacoviello. "Optimal Control of Virus Spread under Different Conditions of Resources Limitations". To appear in *Information*. 2019.
- Di Giamberardino, P. and D. Iacoviello. "Optimal control to limit the propagation effect of a virus outbreak on a network". To appear in *Proc. of the 16th Int. Conf. on Informatics in Control, Automation and Robotics (ICINCO 2019)*. 2019.
- Di Giamberardino, P. and D. Iacoviello. "Optimal Resource Allocation to Reduce an Epidemic Spread and Its Complication". To appear in *Information*. 2019.
- Di Giamberardino, P. and D. Iacoviello. "The influence of the choice of the cost index on the effectiveness of optimal resources allocation strategies for Hepatitis B Virus treatment". To appear in *Proc. of the 17th European Control Conference 2019 (ECC 2019)*. 2019.
- Elobaid, M., M. Mattioni, S. Monaco, and D. Normand-Cyrot. "On MPC through Multi-rate Sampling". To appear in *Proc. of Joint Mechatronics 2019 & NolCoS 2019*. 2019.
- Iacoviello, D. "Physiological Cybernetics: Methods and Applications". To appear in *New Developments on Computational Methods and Imaging in Biomechanics and Biomedical Engineering*. 2019.
- Mattioni, M. and S. Monaco. "On Collective Behaviors of Networks of Heterogeneous Dynamical Systems". Submitted to *IEEE Transactions on Automatic Control*. 2019.
- Mattioni, M., S. Monaco, and D. Normand-Cyrot. "Forwarding stabilization in discrete time". Submitted to *Automatica*. 2017.

- Mattioni, M., S. Monaco, and D. Normand-Cyrot. "On the Zero Dynamics of a Class of Hybrid LTI Systems: a Geometric Approach". To appear in *IEEE Control System Letters (L-CSS)*. 2019.
- Mattioni, M., S. Monaco, and D. Normand-Cyrot. "Feedforwarding under Sampling". To appear in *IEEE Transactions on Automatic Control*. 2019.
- Monaco, S., D. Normand-Cyrot, and M. Mattioni. "Nonlinear Sampled-Data Stabilization with Delays". To appear in *Lecture Notes in Control and Information Sciences at Springer*. 2019.
- Monaco, S. and L. Ricciardi Celsi. "On multi-consensus and almost equitable graph partitions". To appear in *Automatica*. 2019.
- Moreschini, A., M. Mattioni, S. Monaco, and D. Normand-Cyrot. "Discrete Port-Controlled Hamiltonian Dynamics and Average Passivation". To appear in the *Proc. of the 58th IEEE Conference on Decision and Control (CDC)*. 2019.
- Moreschini, A., M. Mattioni, S. Monaco, and D. Normand-Cyrot. "Interconnection through u -Average Passivity in Discrete Time". To appear in the *Proc. of the 58th IEEE Conference on Decision and Control (CDC)*. 2019.
- Moreschini, A., S. Monaco, and D. Normand-Cyrot. "Gradient and Hamiltonian Dynamics under Sampling". To appear in *Proc. of Joint Mechatronics 2019 & NolCoS 2019*. 2019.

Robotics

Journal Papers

- Al Khudir, K. and A. De Luca. "Faster Motion on Cartesian Paths Exploiting Robot Redundancy at the Acceleration Level". In: *IEEE Robotics and Automation Letters* 3.4 (2018), pp. 3553–3560. DOI: 10.1109/LRA.2018.2853806.
- Cefalo, M., E. Magrini, and G. Oriolo. "Sensor-Based Task-Constrained Motion Planning using Model Predictive Control". In: *IFAC-PapersOnLine* 51.22 (2018), pp. 220–225. DOI: 10.1016/j.ifacol.2018.11.545.
- Gaz, C., E. Magrini, and A. De Luca. "A Model-Based Residual Approach for Human-Robot Collaboration During Manual Polishing Operations". In: *Mechatronics* 55 (2018), pp. 234–247. DOI: 10.1016/j.mechatronics.2018.02.014.
- Karami, A., H. Sadeghian, M. Keshmiri, and G. Oriolo. "Hierarchical Tracking Task Control in Redundant Manipulators with Compliance Control in the Null-Space". In: *Mechatronics* 55 (2018), pp. 171–179. DOI: 10.1016/j.mechatronics.2018.09.005.
- Meli, L., C. Pacchierotti, G. Salvietti, F. Chinello, M. Maisto, A. De Luca, and D. Praticchizzo. "Combining Wearable Haptics and Augmented Reality: User Evaluation Using an External Camera and the Microsoft HoloLens". In: *IEEE Robotics and Automation Letters* 3.4 (2018), pp. 4297–4304. DOI: 10.1109/LRA.2018.2864354.
- Zamparelli, A., N. Scianca, L. Lanari, and G. Oriolo. "Humanoid Gait Generation on Uneven Ground using Intrinsically Stable MPC". In: *IFAC-PapersOnLine* 51.22 (2018), pp. 393–398. DOI: 10.1016/j.ifacol.2018.11.574.

Conference Proceedings

- Cacciotti, N., A. Cifonelli, C. Gaz, V. Paduano, A. Russo, and M. Vendittelli. “Enhancing Force Feedback in Teleoperated Needle Insertion Through On-line Identification of the Needle-Tissue Interaction Parameters”. In: *Proc. of 7th IEEE RAS/EMBS International Conference on Biomedical Robotics and Biomechatronics*. 2018, pp. 79–85. DOI: 10.1109/BIOROB.2018.8487952.
- Charbonneau, M., V. Modugno, F. Nori, G. Oriolo, D. Pucci, and S. Ivaldi. “Learning Robust Task Priorities of QP-Based Whole-Body Torque Controllers”. In: *Proc. of 2018 IEEE-RAS International Conference on Humanoid Robots*. 2018, pp. 622–627. DOI: 10.1109/HUMANOIDS.2018.8624995.
- Ferrari, P., M. Cagnetti, and G. Oriolo. “Anytime Whole-Body Planning/Replanning for Humanoid Robots”. In: *Proc. of 2018 IEEE-RAS International Conference on Humanoid Robots*. 2018, pp. 209–216. DOI: 10.1109/HUMANOIDS.2018.8624935.
- Fontanelli, G. A., M. Selvaggio, M. Ferro, F. Ficuciello, M. Vendittelli, and B. Siciliano. “A V-REP simulator for the da Vinci Research Kit robotic platform”. In: *Proc. of 7th IEEE RAS/EMBS International Conference on Biomedical Robotics and Biomechatronics*. 2018, pp. 1056–1061. DOI: 10.1109/BIOROB.2018.8487187.
- Penco, L., B. Clement, V. Modugno, E. M. Hoffman, G. Nava, D. Pucci, N. Tsagarakis, J.-B. Mouret, and S. Ivaldi. “Robust Real-Time Whole-Body Motion Retargeting from Human to Humanoid”. In: *Proc. of 2018 IEEE-RAS International Conference on Humanoid Robots*. 2018, pp. 425–432. DOI: 10.1109/HUMANOIDS.2018.8624943.

Other (Books, Technical Reports, Submitted Papers, etc.)

- Al Khudir, K., G. Halvorsen, L. Lanari, and A. De Luca. “Stable Torque Optimization for Redundant Robots Using a Short Preview”. To appear in *IEEE Robotics and Automation Letters*. 2019.
- Caron, S., A. Escande, L. Lanari, and B. Mallein. “Capturability-based Pattern Generation for Walking with Variable Height”. To appear in *IEEE Transactions on Robotics*. 2019.
- Cefalo, M. and G. Oriolo. “A General Framework for Task-Constrained Motion Planning with Moving Obstacles”. To appear in *Robotica*. 2019.
- Ferrari, P., M. Cagnetti, and G. Oriolo. “Sensor-Based Whole-Body Planning/Replanning for Humanoid Robots”. Submitted to *2019 IEEE/RSJ International Conference on Intelligent Robots and Systems*. 2019.
- Ferrari, P., N. Scianca, L. Lanari, and G. Oriolo. “An Integrated Motion Planner/Controller for Humanoid Robots on Uneven Ground”. To appear in *Proc. of 2019 European Control Conference*. 2019.
- Ferro, M., A. Paolillo, A. Cherubini, and M. Vendittelli. “Vision-Based Navigation of Omnidirectional Mobile Robots”. To appear in *IEEE Robotics and Automation Letters*. 2019.
- Fontanelli, G. A., M. Selvaggio, M. Ferro, F. Ficuciello, M. Vendittelli, and B. Siciliano. “Portable dVRK: An augmented V-REP Simulator of the da Vinci Research Kit”. To appear in *Acta Polytechnica Hungarica*. 2019.
- Gaz, C., M. Cagnetti, A. Oliva, P. Robuffo Giordano, and A. De Luca. “Dynamic Identification of the Franka Emika Panda Robot with Retrieval of Feasible Parameters”. Submitted to *IEEE Robotics and Automation Letters*. 2019.

- Karami, A., H. Sadeghian, M. Keshmiri, and G. Oriolo. "Force, Orientation and Position Control in Redundant Manipulators in Prioritized Scheme with Null Space Compliance". To appear in *Control Engineering Practice*. 2019.
- Kheddar, A., S. Caron, P. Gergondet, A. Comport, A. Tanguy, C. Ott, B. Henze, G. Mesesan, J. Engelsberger, M. Roa, P.-B. Wieber, F. Chaumette, F. Spindler, G. Oriolo, L. Lanari, A. Escande, K. Chappellet, F. Kanehiro, and P. Rabaté. "Humanoid Robots in Aircraft Manufacturing – The Airbus Use-Cases". Submitted to *IEEE Robotics and Automation Magazine*. 2019.
- Magrini, E., F. Ferraguti, A. Renga, F. Pini, A. De Luca, and F. Leali. "Human-Robot Coexistence and Interaction in Open Industrial Cells". Submitted to *Robotics and Computer-Integrated Manufacturing*. 2019.
- Mariotti, E., E. Magrini, and A. De Luca. "Admittance Control for Human-Robot Interaction Using an Industrial Robot Equipped with a F/T Sensor". To appear in *Proc. of 2019 IEEE International Conference on Robotics and Automation*. 2019.
- Penco, L., N. Scianca, V. Modugno, L. Lanari, G. Oriolo, and S. Ivaldi. "A Multi-Mode Teleoperation Framework for Humanoid Loco-Manipulation". Submitted to *IEEE Robotics and Automation Magazine*. 2019.
- Scianca, N., D. De Simone, L. Lanari, and G. Oriolo. "MPC for Humanoid Gait Generation: Stability and Feasibility". Submitted to *IEEE Transactions on Robotics*. 2019.
- Tanguy, A., D. De Simone, A. I. Comport, G. Oriolo, and A. Kheddar. "Closed-Loop MPC with Dense Visual SLAM – Stability through Reactive Stepping". To appear in *Proc. of 2019 IEEE International Conference on Robotics and Automation*. 2019.