

Matteo Matteucci

Curriculum Vitae et Studiorum

Name: Matteo Matteucci
Date/Place of Birth: 23/04/1974, Nuoro (Italy)
Affiliation: Politecnico di Milano
Dip. di Elettronica, Informazione e Bioingegneria
Address: Via Ponzio 34/5, I-20133, Milan (Italy)
E-mail: matteo.matteucci@polimi.it
Phone/Fax: +39 02 2399 3470 / 3411
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Executive Summary	2
Biosketch	3
Education	3
Academic Life	
Academic Positions	4
Academic Roles and Affiliations	4
Evaluation Committees	4
Prizes and Awards	5
Other	5
Teaching Activity	
Lecturer and Teaching Assistant (PhD, MS, BS)	6
Other Teaching Activities	7
Supervision of PhD Students	
Advised PhD Students	8
Co-Advised PhD Students	8
PhD Thesis Reviewer	9
International Editorial Activity	
International Committees	9
International Journal and Conference Editorial Role	9
International Conferences and Workshops Program Committees	10
Reviewer for International Journals and Magazines	10
Reviewer for International Conferences and Workshops	10
Session Chair and co-Chair	11
Workshop and Conference Organization	11
Projects and Funding	
Research Projects	12
Industrial Projects and Contracts	13
Professional Activities	14
Research Statement	
Research Achievements, Results, and Products	15
Invited Talks & Papers	18
Full List of Publications	
A. Articles in International Journals	19
B. Articles and Chapters in International Books	22
C. National and International Patents	24
D. Papers in Proceedings of International Conferences and Workshops	24
E. Articles in Collections	33
F. Articles in National Journals	33
G. Technical Reports	34
H. Accepted for Publication	34

Date: 01/12/2018

My research has focused on the use of techniques and models from Pattern Recognition, Machine Learning, Signal Processing and Dynamic State Estimation for dealing with uncertainty in autonomous systems perception and intelligent data analysis (a.k.a machine learnign). Autonomous robots, unmanned vehicles, and assistive technologies (where system autonomy is used to supply user physical or cognitive deficits) have been reference scenarios for developing models and algorithms to cope with uncertainty and incomplete knowledge learned from data.

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Publications: more than: 50 International Journal papers, 25 papers in International Books, 150 contributions to International Conferences and Workshops.

International Activity: Visiting Scholar for 1 year at Carnegie Mellon University where I got also a Master of Science in Knowledge Discovery and Data Mining. Active since its foundation in the Euron Special Interest Group on Good Experimental Methodologies & Benchmarking (GEM SIG) for the design of suitable benchmarks and experimental methodologies for intelligent systems. Expert on Benchmarking for the RoSta and on ELS (Ethical-Legal-Societal) issues for the euRobotics FP7 projects. Active in the IEEE RAS Standard Group in the “IEEE 1873-2015 Standard for Robot Map Data Representation” and “IEEE P2751 - 3D Map Data Representation for Robotics and Automation”. Part of IFAC Technical Committee “7.5. Transportation and Vehicle Systems - Intelligent Autonomous Vehicles”. Program Committee of 8 International Conferences. Reviewer for 15 International Journals (out of which 7 IEEE Transactions) and more than 20 International Conferences & Workshops.

Project Funding: Project Coordinator of FP6 European project RAWSEEDS, National Scientific Coordinator of PRIN 2009 project ROAMFREE, POLIMI Principal Investigator for FP7 project RoCKIn, POLIMI Principal Investigator for H2020 project RoCKEU2, POLIMI Principal Investigator & Project Technical Manager of AAL Joint Program project ALMA, Coordinator of “Brain-Computer Interfaces in Everyday Applications” Politecnico di Milano and Regione Lombardia grant.

Research achievements/products: An autonomous wheelchair with multimodal interface to support disabled people mobility (awarded with Antonio D’Auria SIRI Prize, and Intesa Startup Initiative), a benchmarking toolkit for simultaneous localization and mapping (often cited, as example of benchmarking and excellent EU project, by EU officers in their presentations), a Brain-Computer Interface based on P300 and ErrP potentials (presented to the general public and reported by the national and international press), a sensor fusion framework for the odometry of unmanned vehicle actually deployed and running on several vehicles at Politecnico di Milano (AIRLab and MERLIN) and Università di Milano-Bicocca (IRALab). Co-author of “*General Guidelines for Robotics Papers Involving Experiments*” (Euron GEM SIG). Co-author of the “*Suggestion for a green paper on legal issues in robotics*” (euRobotics ESL SIG).

Technology Transfer: 5 patents (2 Italian + 2 European counterparts + 1 patent request), 1 spin-off company founded with a PhD student (Nova Labs), 1 start-up company founded by PhD students (Empatica), 2 tech-transfer award (Antonio D’Auria, Intesa San Paolo “Startup Initiative”), industrial collaboration/contracts (e.g., with Aerosekur, Indesit, Gaiotto, Infosolution, Noustat, Aermatica, Aster).

Awards and Prizes: Rotary Ambassadorial Scholarship; Dimitris N. Chorafas Foundation Award for best PhD thesis; the autonomous wheelchair project has been awarded with “Antonio D’Auria” and the Intesa San Paolo “Startup Initiative” prizes; advisor of Luigi Malagò awarded with the Dimitris N. Chorafas Foundation Award for best PhD thesis; tutor of the “Helios” project awarded as the best project of the first 6 years of Alta Scuola Politecnica, and of the “IRoKi” project, which was another of the 6 finalists.

Lecturer (Grade, Years): Soft Computing (PhD, 5Ys), 3D Structure from Visual Motion (PhD, 4Ys), Deep Learning (PhD, 1Y), Machine Learning (MS, 4Y), Robotics (MS, 3Y), Cognitive Robotics (MS, 2Ys), Pattern Analysis & Machine Intelligence (MS, 5Ys), Metodologie per Sistemi Intelligenti (MS, 2Ys), Knowledge Engineering (BS, 5Ys), Fondamenti Informatica (BS, 4Ys), Teaching Assistant: Soft Computing (MS, 9Ys), Knowledge Engineering & Expert Systems (BS, 5Ys), Information Retrieval and Data Mining (MS, 2Ys), Cognitive Robotics (MS, 1Ys).

Multidisciplinary research: I pursue multidisciplinary both in the narrow sense of “within engineering” (i.e., Pattern Recognition, Machine Learning, Signal Processing, Dynamic State Estimation, Robotics), and in the broader sense of “involving other disciplines” (e.g., Neurosciences, Geology and Environmental Science, Medicine, Transportation Science, Bioengineering, Mathematics, Social Sciences, Genomics).

Matteo Matteucci - "Laurea" degree 1999 (Politecnico di Milano), MS 2002 (Carnegie Mellon University), PhD 2003 (Politecnico di Milano) is Associate Professor at the "Dipartimento di Elettronica Informazione e Bioingegneria" of Politecnico di Milano. In 1999 he got a Laurea degree in *Computer Engineering* at Politecnico di Milano, in 2002 he got a Master of Science in *Knowledge Discovery and Data Mining* at Carnegie Mellon University (Pittsburgh, PA), and in 2003 a PhD in *Computer Engineering and Automation* at Politecnico di Milano (Milan, Italy).

He is actually working in both Robotics and Machine Learning, mainly developing, with a practical perspective, techniques models and methodologies for the deployment of adaptation and learning on autonomous (robotics) systems in real world dynamic environments. His research is on robot control architectures, middleware for robot integration, reactive robot control, computer vision, adaptive color models, robust tracking for video surveillance, behavior modeling, and all sorts of learning machines (i.e., neural network, decision trees, mixture models, Bayesian networks, etc.) applied to real world scenarios.

He has published more than 45 (peer-reviewed) papers on international journals, 20 papers in International Books, and more than 140 (peer-reviewed) contributions to international conferences and workshops. He is part of the Program Committee of several conferences on Artificial Intelligence and Robotics, he is in the Technical Committee of Intelligent Autonomous Vehicles of the International Federation of Automatic Control, and he serves as reviewer for international journals and main conferences in his field of expertise.

He has been the Coordinator of the European project RAWSEEDS – FP6-045144 (2006-2009, <http://www.rawseeds.org>) a Specific Support Action in the FP6 for the development of a benchmarking toolkit for multi-sensor SLAM algorithms. He has been the National Scientific Coordinator (Principal Investigator) of the ROAMFREE project (2009-2013, <http://roamfree.dei.polimi.it>) for the development of method for the robust estimation of robot odometry by sensor fusion funded by the Italian Ministry for the University and the Research (MIUR) under the PRIN 2009 program.

He has been the Principal Investigator for the Politecnico di Milano of the FP7 project RoCKIn and Project Technical Manager of the European project ALMA (2013-2016, <http://www.alma-aal.org>), funded under the AAL Joint Program, for the realization of an Ambient Assisted Living system to support the autonomous mobility of the elderly. He has been Principal investigator for Politecnico di Milano of the H2020 project RockEU2 and for the development of the European Robotics League. He has been investigator in the SINOPIAE project funded by Regione Lombardia and the Italian Ministry of University and Research (MIUR) for the development of an Unmanned Aerial Vehicle able to reconstruct the thermal dispersion of buildings at the district level through a visual and thermal custom payload.

Education

2000 - 2003 PhD in Computer Engineering and Automation at the Department of Electronics and Information of Politecnico di Milano (17/03/2003, Milan, Italy) [PhD Thesis title: *Evolutionary Learning of Adaptive Models within a Bayesian Framework*]. Advisor: Prof. Andrea Bonarini. Awarded with the Dimitris N. Chorafas Prize for the best PhD thesis by the Chorafas Foundation.

2001 - 2002 Master of Science in Knowledge Discovery and Data Mining at the "Center for Automatic Learning & Discovery" (08/2002, Carnegie Mellon University, Pittsburgh, PA) [MS Thesis title: *ELeaRNT: Evolutionary Learning of Rich Neural Network Topologies*]. Advisor: Prof. Manuela Veloso.

1993 - 1999 Laurea degree in Computer Engineering at Politecnico di Milano (19/04/1999, Milan, Italy) [Thesis title: *Rappresentazione della conoscenza fuzzy e a intervalli per algoritmi di apprendimento per rinforzo applicati ad agenti situati*]. Advisor: Prof. Andrea Bonarini.

Academic Positions

- Since 2015* Associate Professor at the Department of Electronics Information and Bioengineering of Politecnico di Milano (Milan, Italy).
- 2008 - 2015* Assistant Professor (Ricercatore di ruolo confermato) at the Department of Electronics and Information of Politecnico di Milano (Milan, Italy).
- 2005 - 2008* Assistant Professor (Ricercatore di ruolo) at the Department of Electronics and Information of Politecnico di Milano (Milan, Italy).
- 2003 - 2005* Research Assistant (Assegnista di Ricerca) in the research program “Evoluzione tecnologica e nuove applicazioni delle basi di dati e dei sistemi informativi” at the Department of Electronics and Information of Politecnico di Milano (Milan, Italy).
- 2000 - 2003* PhD Student in the Computer Engineering and Automation program at the Department of Electronics and Information of Politecnico di Milano (Milan, Italy).
- 2001 - 2002* Visiting Student at the Center for Automatic Learning and Discovery at Carnegie Mellon University (Pittsburgh, PA - USA).
- 2000 - 2002* Research Assistant (Assegnista di Ricerca) in the research program “Modelli di apprendimento automatico in ambienti dinamici” at the Department of Electronics and Information of Politecnico di Milano (Milan, Italy).

Academic Roles and Affiliations

- 2018 - 2020* Scientific Director of the “Master di I livello in Artificial Intelligence and Machine Learning” offered by Politecnico di Milano.
- Since 2018* Member of the Italian Association for Computer Vision, Pattern Recognition and Machine Learning (CVPL)
- Since 2018* Member of the Faculty Board of the “Data Analytics and Decision Sciences” PhD Program at Politecnico di Milano
- Since 2016* Segretario Consiglio Corso di Studi in Ingegneria Informatica (secretariat of the Computer Science and Engineering program) of Politecnico di Milano
- Since 2015* Reviewer for the Italian Ministry for University and Research registered to “REPRIZE: Register of Expert Peer Reviewers for Italian Scientific Evaluation”
- Since 2015* Commissioner (and co-founder in 2014) of the Interaction between Driver, Road Infrastructure, Vehicle, and Environment (I.DRIVE) interdepartmental laboratory of Politecnico di Milano (<http://idrive.polimi.it>).
- Since 2013* Representative (and co-founder in 2012) of the Assistive Technology Group of Politecnico di Milano - Polo Regionale di Como (<http://atg.deib.polimi.it>).
- Since 2010* Member of “Commissione Didattica Laurea Specialistica” for the Computer Engineering track of Politecnico di Milano - Polo Regionale di Como.
- Since 2009* Member of “Commissione Orari” for the Computer Engineering track of Politecnico di Milano - Polo Regionale di Como.
- Since 2008* “Delegato SAT” (Struttura Accademica dei Tirocini) for the Computer Engineering track at Politecnico di Milano - Campus Leonardo.
- Since 2007* Member of IEEE, the Institute of Electrical and Electronics Engineers (Computational Intelligence Society, Robotics and Automation Society).
- Since 2000* Member of the Artificial Intelligence and Robotics Lab of Politecnico di Milano.
- 2012 - 2015* Reviewer for the Italian Ministry of University and Research (Iscritto all’Albo Revisori MIUR).
- 2012 - 2013* National Action co-Leader for the “Health & Wellbeing” Action Line of the Italian Node of European Institute for Innovation and Technology (EIT).
- 2000 - 2005* Member of AI*IA, Associazione Italiana per l’Intelligenza Artificiale.

Evaluation Committees

- 21/09/2018 Member of Final Examination Commission for the PhD program in Computer and Control Engineering of Politecnico di Torino
- 27/08/2018 Member of “Commissione di valutazione dell’attività didattica e di ricerca” for the renewal of a Temporary Researcher contract (Ricercatore 240/2010) for Università di Parma.
- 17/05/2018 Member of Final Examination Commission for the PhD program in Computer and Control Engineering of Politecnico di Torino
- 22/02/2017 Member of Final Examination Commission for the PhD in Computer Engineering at the Department of Electronics Information and Bioengineering of Politecnico di Milano
- 07/02/2017 Member of Final Examination Commission for the PhD in Mechanical Engineering at the Department Mechanical Engineering of Politecnico di Milano
- 11/16-01/17 Member of Commission for the 09/H1 (ING-INF/05) RTDa position (Temporary Researcher) for the “Progetto H2020 INTCATCH”, Dipartimento di Informatica, Università degli Studi di Verona
- 29/04/2016 Member of Final Examination Commission for the PhD in Computer Engineering at the Department of Electronics Information and Bioengineering of Politecnico di Milano
- 15/04/2014 Member of Final Examination Commission for the PhD in Meccatronica at Politecnico di Torino.

Prizes and Awards

- In 2018 Awarded with a 20K\$ Microsoft Azure sponsorship grant as a support for the PhD Course on “Deep Learning: Theory Techniques and Applications”.
- In 2017 Awarded with a 20K\$ Microsoft Azure sponsorship grant for the experimentation of Deep Learning machine on the cloud
- 01/07/2016 *Best Paper Award* for the paper “ReSeg: A Recurrent Neural Network-based Model for Semantic Segmentation” at DeepVision 2016, International Workshop on Deep Learning in Computer Vision in conjunction with CVPR 2016.
- 10/03/2016 *Best Paper Award (people choice)* for the paper “Automatic 3D Reconstruction of Manifold Meshes via Delaunay Triangulation and Mesh Sweeping” at 2016 IEEE Winter Conference on Applications of Computer Vision (<http://wacv16.wacv.net/index.html?p=1225.html>)
- In 2015 Awarded by NVIDIA with a Titan X GPU within the Academic Hardware Grant
- In 2014 Awarded, with Dott. Martino Migliavacca and Prof. Andrea Bonarini, of “THE BUSINESS GRANT AND THE ACCELERATION PROGRAM” with the project R2P in the Working Capital Accelerator program (WCAP 2014) by Telecom Italia.
- In 2014 Winner, with Prof. Sara Comai (referente), of the “POLISOCIAL AWARD 2014” with the project proposal “MEP: Maps for Easy Paths”.
- In 2011 Winner, with the Industrial Partner Infosolution SpA, of “Premio Antonio D’Auria 2010 per progetti e prototipi di dispositivi meccatronici innovativi di ausilio a disabili motori” from Società Italiana di Robotica e Automazione (infosolution.it, corriere.it, robosiri.it).
- In 2011 Winner, with the Industrial Partner Infosolution SpA, of the Intesa San Paolo “Startup Initiative” and the Italian round of the “Global Social Venture Competition” with the RobyWheelChair project (infosolution.it, lobbyinnovazione.it).
- In 2003 Winner of the Dimitris N. Chorafas Foundation Award for the best PhD thesis.
- 2001 - 2002 Winner of the Rotary Foundation Ambassadorial Scholarship.

Other

- In 2018 Reviewer for FONDECYT, the Chilean National Science and Technology Commission
- Since 2017 National Scientific Qualification (“Abilitazione Nazionale” art.16 of the law 30 Dec. 2010, n.240) “Professore I fascia” for sector 09/H1.

- Since 2013* National Scientific Qualification (“Abilitazione Nazionale” art.16 of the law 30 Dec. 2010, n.240) “Professore II fascia” for sector 09/H1.
- Since 2013* National Scientific Qualification (“Abilitazione Nazionale” art.16 of the law 30 Dec. 2010, n.240) “Professore II fascia” for sector 01/B1.
- In 2014* Review and *rappporteur* for the SIR 2014 (Scientific Independence of young Researchers) funding program by the Italian Ministry of University and Research (MIUR)
- In 2011* Reviewer for the PRIN 2010-2011 (Programmi di Ricerca Scientifica di Rilevante Interesse Nazionale) funding program by the Italian Ministry of University and Research (MIUR)

Teaching activity

Lecturer and Teaching Assistant (PhD, MS, BS)

- 2018 **Lecturer and coordinator** for the PhD course “Deep Learning: Theory, Techniques and Applications” in the PhD program in Information Engineering at Dipartimento di Elettronica Informazione e Bioingegneria del Politecnico di Milano
- 2014-2012-2010-2009: **Lecturer and coordinator** for the PhD course “3D Structure from Visual Motion: Novel Techniques in Computer Vision and Autonomous Vehicles” in the PhD Program in Information Engineering at Dipartimento di Elettronica Informazione e Bioingegneria of Politecnico di Milano.
- 2017-2015-2012-2010-2007-2005-2003: **Lecturer** for the PhD course “Soft Computing: Theory, Techniques and Applications” in the PhD Program in Information Engineering at Dipartimento di Elettronica Informazione e Bioingegneria of Politecnico di Milano.
- Since 2017* **Lecturer and coordinator** for the course “Cognitive Robotics” of the Computer Engineering degree, Scuola di Ingegneria Industriale e dell’Informazione, Politecnico di Milano - Polo Regionale di Como.
- Since 2016* **Lecturer and coordinator** for the course “Machine Learning” of the Computer Engineering degree, Scuola di Ingegneria Industriale e dell’Informazione, Politecnico di Milano - Polo Regionale di Como.
- Since 2016* **Lecturer and coordinator** for the course “Robotics” of the Computer Engineering degree, Scuola di Ingegneria Industriale e dell’Informazione, Politecnico di Milano.
- Since 2004* **Teaching assistant** on Natural Computation for the course “Soft Computing” in the Computer Engineering degree, Scuola di Ingegneria Industriale e dell’Informazione (formerly Facolta' di Ingegneria Informatica), Politecnico di Milano - Campus Leonardo,
- 2011 - 2016 **Lecturer and coordinator** of the Laurea Specialistica course “Pattern Analysis and Machine Intelligence” for the Computer Engineering degree, Scuola di Ingegneria Industriale e dell’Informazione (formerly Scuola di Ingegneria dell’Informazione), Politecnico di Milano - Polo Regionale di Como
- 2014 - 2015 **Teaching assistant** for the course “Cognitive Robotics” of the Computer Engineering degree, Scuola di Ingegneria Industriale e dell’Informazione, Politecnico di Milano.
- 2015 **Lecturer** on Data Mining for the course “Information Retrieval and Data Mining” of the Computer Engineering degree, Scuola di Ingegneria Industriale e dell’Informazione, Politecnico di Milano - Polo Regionale di Como.
- 2013-2014 **Teaching assistant** on Data Mining for the course “Information Retrieval and Data Mining” of the Computer Engineering degree, Scuola di Ingegneria Industriale e dell’Informazione, Politecnico di Milano - Polo Regionale di Como.
- 2009 - 2013 **Lecturer and coordinator** of the Laurea course “Knowledge Engineering” for the Computer Engineering degree, Facolta' di Ingegneria dell’Informazione, Politecnico di Milano - Polo Regionale di Como.
- 2006 - 2007 **Lecturer and coordinator** of the Laurea Specialistica course “Methods for Intelligent Systems” for the Computer Engineering degree, Facolta' di Ingegneria dell’Informazione, Politecnico di Milano - Polo Regionale di Como.

- 2003 - 2007 **Lecturer and coordinator** of the Laurea course “Fondamenti di Informatica” for the Electronics Engineering degree, Facolta' di Ingegneria dell'Informazione, Politecnico di Milano - Campus Leonardo.
- 2003 - 2007 **Teaching assistant** on Natural Computation for the Laurea course “Knowledge Engineering and Expert Systems” for the Computer Engineering degree, Facolta' di Ingegneria Informatica, Politecnico di Milano - Polo Regionale di Como.
- 1999 - 2001 **Teaching assistant** on C Language for the Laurea course “Fondamenti di Informatica (B)” for the Environmental Engineering degree, Facolta' di Ingegneria Civile, Ambientale e Territoriale, Politecnico di Milano - Campus Leonardo.

Other Teaching Activities

Since 2003 I have been advisor and co-advisor for more than 50 Laurea thesis (Master Level) at Politecnico di Milano

29/03/2018, 05/04/2018, 12/04/2018, 18/04/2018 **Lecturer** on “Advanced Machine Learning” in the [Regione Lombardia] III Ed. Master Universitario in Alto Apprendistato e Ricerca on Analytics & Business Intelligence at CEFRIEL.

27/02/2018, 28/02/2018 **Lecturer** on “Modulo Big Data” in the [Regione Lombardia] Master Universitario in Alto Apprendistato e Ricerca on Industry 4.0 - BOSCH at CEFRIEL.

12/01/2018 **Lecturer** on “Learning & Vision for Autonomous Machines” in the Advanced Master in Innovation and Entrepreneurship at MIP, Politecnico di Milano Graduate School of Business

23/05/2016 **Invited lecturer** on “Hidden Markov Models” in the Laurea Specialistica course “Machine Learning” by Prof. Marcello Restelli in the Computer Science and Engineering Program of Politecnico di Milano

07/04/2016, 11/04/2016 **Invited lecturer** on “Deep Learning and Neural Networks” in the Laurea Specialistica course “Machine Learning” by Prof. Marcello Restelli in the Computer Science and Engineering Program of Politecnico di Milano

04/04/2017, 17/04/2015, 08/05/2014, 09/04/2013, 04/05/2012, 29/04/2011 **Invited lecturer** on “Brain-Computer Interfaces @AIRLab” in the Laurea Specialistica course “Accessibility” by Prof. Licia Sbattella in Computer Engineering degree of Politecnico di Milano - Polo Regionale di Como

15/04/2015 **Invited lecturer** on “An Introduction to Computer Vision” in the ISEP - 8th International Week - “Inspiring Engineering” at the Instituto Superior de Engenharia do Porto, Porto (Portugal).

2010 - 2012 **Tutor** for the Alta Scuola Politecnica (<http://www.asp-poli.it>) project “TSC4MiTo: The Social Computing for Milano and Torino”.

25/05/2012 **Invited lecturer** on “Robotics benchmarking from the inside: The RAWSEEDS Experience” for the PhD course on “Computing and Science” by Prof. Viola Schiaffonati and Prof. Francesco Amigoni from the Dipartimento di Elettronica e Informazione del Politecnico di Milano

2009 - 2011 **Tutor** for the Alta Scuola Politecnica project “WillChair: reinventing the wheels ... into wills!” from which the project “Clever” has won the “Lifeability Award” in the Bioengineering category

2006 - 2008 **Tutor** for the Alta Scuola Politecnica project “SenSoBot: Sensors and control for Societal Robots”

2005 - 2007 **Tutor** for the Alta Scuola Politecnica project “WoMan: Windows On Man”, from which the project “Helios” has been awarded as the best multidisciplinary project for the first 6 years of Alta Scuola Politecnica during the event “[Riconoscere e premiare l'eccellenza e l'innovazione - una sfida per l'Italia che crede nel futuro](#)” (ASP + Confindustria)

17/11/2006 **Lecturer** on Neural Networks for the course “Cybernetics” in the “Sapere a tutto campo” program at Università Bocconi

2005 - 2006 **Tutor** for the Alta Scuola Politecnica project “IRoPa: Intelligent Robotic Partners”

2005 - 2006 **Tutor** for the Alta Scuola Politecnica project “AMoRoSA: Autonomous Mobile Robots for Service Applications”. The team “IeRoKi” (<http://www.ieroki.it/>) has been selected in 2012 among the 6 best ASP project in the 2006-2012 years (award won by the “Helios” project, 2005-2007 period)

- 06/09/2006 **Lecturer** on “Soft Computing: Neural Networks Theory and Applications” Continuous Education course for an Italian Company (company name undisclosed for NDA clause)
- 26/05/2005 **Lecturer** on “Dal filtraggio alla Kalman ai filtri a particelle” for the Laurea course “Robotica complementi” for the Computer Science degree, Facolta' di Scienze Fisiche e Naturali, Università degli Studi di Milano-Bicocca.
- 20/05/2005 **Lecturer** on “Tecniche di filtraggio Bayesiano” for the Laurea course “Robotica complementi” for the Computer Science degree, Facolta' di Scienze Fisiche e Naturali, Università Degli Studi Milano-Bicocca..
- 26/04/2004 **Invited lecturer** on “Perchè oggi non servono (ancora) le tre leggi della robotica?” for the thematic session “Dall'Intelligenza Artificiale ai robot” for the Master Program in Scientific Communication at SISSA, Trieste.
- 04/2000 - 06/2000 **Tutoring activity** for the Laurea courses of “Fondamenti di Informatica” for the Engineering degrees of Politecnico di Milano, Campus Bovisa.
- 1997 - 1999 **Tutoring activity** (Computer Science, Calculus and Geometry) for the freshmen at Politecnico di Milano, a.a. 97/98 e a.a. 98/99.

Supervision and Revision of PhD Theses

Advised PhD Students

- Since 2018 Marco Cannici (currently PhD student): Deep Learning and Differentiable Programming
- Since 2018 Francesco Lattari (currently PhD student): Machine Learning and Data Mining for Satellite RADAR Images (in cooperation with TRE-Altamira)
- Since 2017 Alessandro Brusaferrì (currently PhD Executive student): Machine learning for optimization of energy intensive industrial processes
- Since 2017 Simone Mentasti (currently PhD student): Multi sensor fusion in autonomous connected cars (inter-department scholarship with the Mechanical department of Politecnico di Milano)
- Since 2016 Alessandro Gabrielli (currently PhD student): Interaction between Driver and Autonomous Vehicles.
- Since 2016 Marco Ciccone (currently PhD student): Deep Learning for Robotic Vision.
- Since 2014 Gianluca Bardaro (currently PhD student): Design Patterns in Model-based Robotics.
- 2012 - 2017 Andrea Romanoni, “Incremental Large-Scale Visual 3D Mesh Reconstruction”. Post-doc at Politecnico di Milano.
- 2012 - 2017 Francesco Visin, “Deep recurrent neural networks for visual scene understanding”. Research scientist at Google DeepMind (<https://www.linkedin.com/in/francescovisin/>)
- 2011 - 2014 Davide Cucci, “A General Sensor-fusion and Parameters Self-calibration Framework with Applications in Mobile Robotics”. Post-doc at EPFL (<http://personnes.epfl.ch/211269>)
- 2010 - 2013 Simone Ceriani, “Conditionally independent visual slam with integrated bundle adjustment”. Scientific Project Officer at the European Commission Joint Research Centre ([linkedin](https://www.linkedin.com/in/simoneceriani/)).
- 2008 - 2011 Luigi Malagò, “On the geometry of optimization based on the exponential family relaxation”. (**Thesis award:** Dimitris N. Chorafas Foundation). Post-doc at Dipartimento di Informatica, Università degli Studi di Milano ([linkedin](https://www.linkedin.com/in/luigimalago/)).
- 2006 - 2009 Davide Antonio Migliore, “Monocular Simultaneous Localization and Mapping with Bearing-Only Tracking”. Project Manager on Embedded Computer Vision Solutions at Evidence s.r.l. ([linkedin](https://www.linkedin.com/in/davideantonio/)).
- 2005 - 2009 Bernardo Dal Seno, “Toward an Integrated P300-And ErrP-Based Brain-Computer Interface”. Site Reliability Engineer at Google ([linkedin](https://www.linkedin.com/in/bernardodal-seno/)).

Co-Advised PhD Students

- 2014 - 2017 Ludovico Russo (advised by Prof. Basilio Bona at Politecnico di Torino): working on Robot Visual Navigation and Cloud Robotics (Telecom Italia grant).

- 2013 - 2016 Vahid Jalili (advised by Marco Masseroli at Politecnico di Milano): working on data analysis of Next Generation Sequencing (NGS) data for the Genomic Computing project.
- 2010 - 2014 Martino Migliavacca (advised by prof. Andrea Bonarini at Politecnico di Milano), “*The R2P framework for robot prototyping: methodological approach, hardware modules, and software components*”. Post-doc at the AIRLab, Politecnico di Milano ([linkedin](#)).
- 2008 - 2011 Maurizio Garbarino (advised by Prof. Andrea Bonarini at Politecnico di Milano), “*Modeling emotional interaction in affective computing experiments: a study on affect recognition in videogames*”. Chief Science Officer at Empatica S.r.l ([linkedin](#)).
- 2007 - 2010 Simone Tognetti (advised by Prof. Andrea Bonarini at Politecnico di Milano), “*A methodological framework for physiology based affective computing: definition and evaluation*”. CTO & co-founder of Empatica S.r.l ([linkedin](#)).
- 2006 - 2009 Daniele Marzorati (advised by Prof. Domenico G. Sorrenti at Università degli Studi di Milano-Bicocca) “*Uncertainty Modeling in 3D Vision-based SLAM*”. AI Application Engineer at Infosolution SpA ([linkedin](#)).
- 2003 - 2006 Melchiorre Caterina (advised by Prof. Angelo Cavallin at Università degli Studi di Milano-Bicocca) “*Progettazione ed applicazione di modelli quantitativi basati su reti neurali artificiali per la cartografia della suscettibilità connessa a movimenti di versante*”. Researcher at Uppsala University ([linkedin](#)).

PhD Thesis Reviewer

- May 2018 Reviewer for the thesis titled “*Physical Interaction of Autonomous Robots in Complex Environments*” by Giorgio Toscana, PhD program in Computer and Control Engineering of Politecnico di Torino.
- Jan. 2017 Reviewer for the thesis titled “*Robust Feature-based LIDAR Localization and Mapping in Unstructured Environments*” by Fabjan Kallasi, PhD program in Tecnologie dell’Informazione from Università degli Studi di Parma.
- May 2017 Review for the thesis titled “A General Approach to Map Merging on Pose Graphs” by Tiago Maria Buonanni, PhD program in Engineering in Computer Science, Sapienza Università di Roma
- Dec. 2016 Reviewer for the thesis titled “*Metrological Analysis of Time-Of-Flight Cameras Performance for Multipurpose 3D Reconstruction*” by Silvio Giancola, PhD program in Measurement and Experimental Techniques, from Politecnico di Milano.
- May 2014 Reviewer for the thesis titled “Instrumenting and Mining Smart Spaces” by Francesco Leotta, PhD program in Engineering in Computer Science, Sapienza Università di Roma

International Editorial Activities

International Committees

- IEEE RAS Standards Development Working Group “3D-MDR - Robot 3D Map Data Representation”
- IEEE Standardization Committee for the “P1873/D1 Standard for Robot Map Data Representation for Navigation”
- IFAC Technical Committee “7.5. Transportation and Vehicle Systems - Intelligent Autonomous Vehicles”

International Journal and Conference Editorial Role

- Associate Editor for the Special Session on “Research Reproducibility and Benchmarking of Intelligent Robots” of 2018 IEEE/RSJ International Conference on Intelligent RObots and Systems (IROS 2018).
- Associate Editor of 2017 IEEE International Conference on Robotics and Automation (ICRA 2017)

International Conferences and Workshops Program Committees

- EUSIPCO 2018: Technical Program Committee of the 26th European Signal Processing Conference, Area Chair for the “Signal Processing for Robotics” track
- CPSBench 2018: Program Committee of the 1st Workshop on Benchmarking Cyber-Physical Networks and Systems (CPSBench)
- ICARSC 2017: Program Committee of the 17th International Conference on Autonomous Robot Systems and Competitions)
- MOD 2017: Program Committee of the 3rd International Workshop on Machine learning, Optimization and big Data
- IKT2015: 7th International Conference on Information and Knowledge Technology
- MVS 2014: Program Committee of the 3rd IFAC Workshop on Multivehicle Systems
- IAS 2014: Program Committee of the 13th International Conference on Intelligent Autonomous Systems.
- IFAC 2014: Program Committee for International Federation of Automatic Control World Conference.
- IAV 2013 - IAV 2010: Program Committee of IFAC Symposium on Intelligent Autonomous Vehicles.
- CETC 2013: Program Committee of Conference on Electronics, Telecommunication and Computers.
- PPSN 2012: Program Committee of International Conference on Parallel Problem Solving from Nature.
- VS-Games 2011: Program Committee of International Conference in Games and Virtual Worlds for Serious Applications.
- ACII 2011: Program Committee of International Conference on Affective Computing and Intelligent Interaction.
- ISNN 2011: Program Committee of International Symposium on Neural Networks.
- ICANN 2010: Program Committee of International Conference on Artificial Neural Networks.
- ICDS 2009: Program Committee of ACM/IEEE International Conference on Distributed Smart Cameras.
- RoboPer 2008: Program Committee of International Workshop on Robotic Perception.
- RoboVis 2007: Program Committee of International Workshop on Robot Vision.

Reviewer for International Journals and Magazines

- AICom (Artificial Intelligence Communication)
- Automatica
- Computer Methods and Programs in Biomedicine
- Data and Knowledge Engineering Journal
- Evolutionary Computation
- IEEE Transactions on System Man and Cybernetics - Part C
- IEEE Transactions on Automation Science and Engineering
- IEEE Transactions on Evolutionary Computation
- IEEE Transactions on Emerging Topics in Computational Intelligence
- IEEE Transactions on Instrumentation and Measurement
- IEEE Transactions on Neural Networks
- IEEE Transactions on Fuzzy Systems
- IEEE Transactions on Robotics (IEEE TRO)
- IEEE Robotics and Automation Magazine (IEEE RAM)
- IEEE Robotics and Automation Letters (IEEE RA-L)
- IEEE Systems Journal
- International Journal of Advanced Robotic Systems
- Computers in Biology and Medicine
- Sensors
- Robotica

Reviewer for International Conferences and Workshops

- AUTOMOTIVE 2018: Reviewer for the International Conference of Electrical and Electronic Technologies for Automotive
- ICRA 2019, 2018, 2016, 2015, 2014, 2011, 2010, 2008: Reviewer for the IEEE International Conference on Robotics and Automation
- IROS 2017, 2015, 2014, 2013, 2012, 2010: Reviewer for the IEEE/RSJ International Conference on Intelligent Robots and Systems
- MOD 2017: Reviewer for the 3rd Int. Workshop on Machine learning, Optimization and big Data
- RSS 2016: Reviewer for the Robotics: Science and System Conference
- IECON 2016: Reviewer for the 42nd Annual Conference of the IEEE Industrial Electronics Society
- AIRO 2016: Reviewer for the 3rd Italian Workshop on Artificial Intelligence and Robotics
- IJCAI 2015: Reviewer for the International Joint Conference on Artificial Intelligence
- IAS 2014, 2008, 2004, Reviewer for the International Conference on Intelligent Autonomous Systems.
- IFAC WC 2014, 2011, 2008, Reviewers for the International Federation of Automatic Control World Conference.
- CETC 2013, Reviewer for the Conference on Electronics, Telecommunication and Computers.
- ISIEA 2012, Reviewer for the IEEE Symposium on Industrial Electronics and Applications.
- PPSN 2012, Reviewer for the 12th International Conference on Parallel Problem Solving From Nature.
- IJCNN 2012, 2011, 2010, 2009, 2007, Reviewer for the International Joint Conference on Neural Networks.
- MED 2012, Reviewer for the 20th Mediterranean Conference on Control and Automation.
- TAROS 2011: Reviewer for the 12th Conference Towards Autonomous Robotic Systems.
- ISNN 2011, Reviewer for the International Symposium on Neural Networks.
- ACII 2011, Reviewer for the 4th biannual International Conference on Affective Computing and Intelligent Interaction.
- RoboCup 2011, 2010, 2009, 2008, 2007, 2006, 2005 Reviewer for the RoboCup International Symposium.
- ICANN 2010, 2009 Reviewer for the International Conference on Artificial Neural Networks.
- IAV 2010, Reviewer for the 7th Symposium on Intelligent Autonomous Vehicles.
- IEEE CIG 2010, Reviewer for the IEEE Conference on Computational Intelligence and Games.
- CITSA 2009 Reviewer for the 6th International Conference on Cybernetics & Information Technologies, Systems & Applications.
- IEEE WCCI 2008, Reviewers for the IEEE World Congress on Computational Intelligence.
- CIMSIA 2008, Reviewer for the Computational Intelligence for Measurement Systems and Applications conference.
- WILF 2007, Reviewer for the International Workshop on Fuzzy Logic and Applications.

Session Chair and Co-Chair

- IROS 2018, IEEE/RSJ International Conference on Intelligent Robots and Systems, Special Session: "Research Reproducibility and Benchmarking of Intelligent Robots"
- IAS-15 2018, 15th International Conference on Intelligent Autonomous Systems. Session: "3D Sensing"
- IAV 2016, IFAC Intelligent Autonomous Vehicles Symposium 2016. Session "Localization and Mapping"
- IAV 2016, IFAC Intelligent Autonomous Vehicles Symposium 2016. Session "Applications"
- IAS-13 2014, 13th International Conference on Intelligent Autonomous Systems. Session: "Robot Development I"
- IROS 2012 Workshop on Progress, Challenges and Future Perspectives in Navigation and Manipulation Assistance for Robotic Wheelchairs. Session: "Autonomous wheelchair navigation and environment modelling".
- IFAC 2011, World Congress of the International Federation of Automatic Control. Session: "Mechatronics, robotics and components".

- IFAC 2011, World Congress of the International Federation of Automatic Control. Session: "Mission planning and decision making".
- ICRA 2007, IEEE International Conference on Robotics and Automation. Session: "Monocular SLAM".
- IAV 2004, 5th IFAC Symposium on Intelligent Autonomous Vehicles. Session: "Architectures".

Workshop and Conference Organization

- ERF 2018 Workshop on "Research Reproducibility in Robotics" (part of the Competitions and Benchmarking) co-organized with Fabio Bonsignorio, Tampere, Finland, 12th March 2018
- ERF 2017 Workshop on "Robotics Competitions and Challenges" co-organized with Agostino De Santis, Edinburgh, Scotland, 24th March 2017
- IROS 2012 Workshop on "Progress, Challenges and Future Perspectives in Navigation and Manipulation Assistance for Robotic Wheelchairs", Vilamoura, Algarve, Portugal, October 7th to 12th, 2012.
- ICAR 2009 International Workshop on "Benchmarking in Mobile Robotics – State of the Art, Open Challenges, and Research Roadmap –" at the 14th International Conference on Advanced Robotics, Munich, Germany June 22nd to 26th, 2009.

Projects & Fundings

Research Projects

- 2018 - 2021 **Principal Investigator** for Politecnico di Milano (Partner) in the H2020-ICT-780086 European project "SciRoc: European Robotics League plus Smart Cities Robot Competitions". In particular POLIMI is in charge of the benchmarking activities of the European Robotics League continuation and for the Smart City Competitions.
- 2017 - 2021 **Investigator** for Politecnico di Milano (Partner) for the H2020 project "L4MS: Logistics for Manufacturing SMEs" for the development of an integration platform to speed up the deployment of robotics logistics in manufacturing SMEs. (Principal Investigator for Politecnico di Milano prof. Luca Fumagalli DIG)
- 2018 - 2019 **Principal Investigator** for Politecnico di Milano (Partner) for the "Plug&Bench" Integrated Targeted Project (cascade funding schema) within the H2020 project RobMoSys. The goal of the ITP is to design a meta-model for a robot benchmarking component within the RobMoSys Meta-Models Ecosystem.
- 2017 - 2019 **Investigator** for Politecnico di Milano (Partner) of the project "TEINVEIN: Tecnologie per veicoli intelligenti" funded by Regione Lombardia for the development of technologies for autonomous driving. In particular I am involved in the development of sensor fusion technologies. (Principal Investigator for Politecnico di Milano, prof. Franco Zappa)
- 2018 **Principal Investigator** for Politecnico di Milano (Partner) for the EIT Activity A1803 in the EIT-18065 project "Drone112" for the development of a cloud service for the deployment of drones in search and rescue scenarios. In particular I have been involved in the development of machine learning algorithms for the video analytics.
- 2016 - 2018 **Principal Investigator** for Politecnico di Milano (Partner) in the H2020-ICT-688441 European project "RockEU2: Robotics Coordination Action for Europe Two". In particular POLIMI is in charge of the benchmarking activities of the European Robotics League (https://www.eu-robotics.net/robotics_league/).
- 2016 - 2018 **Investigator** for Politecnico di Milano (Partner) in the "GRAPE: Ground Robot for vineyard monitoring and Protection" Experiment in agricultural robotics of the FP7-ICT601116 European project ECHORD++ (<http://www.grape-project.eu/>). (Principal Investigator for Politecnico di Milano, Prof. Luca Bascetta).
- 2017 **Principal Investigator** for Politecnico di Milano (Partner) for the EIT Activity A1703 in the

- EIT-17118 project “Cloud4Drones” for the development of a cloud service for drones. In particular I have been involved in the development of cloud service for 3D reconstruction.
- 2013 - 2015 **Principal Investigator** for Politecnico di Milano (Partner) in the FP7-ICT-601012 European project “RoCKIn: Robot Competitions Kick Innovation in Cognitive Systems and Robotics”. (<http://www.rockinrobotchallenge.eu/>).
- 2013 - 2015 **Project Technical Manager** and **Principal Investigator** for Politecnico di Milano (Partner) in the AAL Joint Program European project “ALMA: Aging without Losing Mobility and Autonomy”. (<http://www.alma-aal.org>).
- 2014 - 2015 **Investigator** and member for Politecnico di Milano (Partner) of the **Technical Board** of OR3 activities (Comfort Manager) of project SHELL (Ecosistemi domestici condivisi ed interoperabili per ambienti di vita sostenibili, confortevoli e sicuri) funded by MIUR as part of the research program “Tecnologie per gli ambienti di vita”. (Scientific director for Politecnico di Milano, Prof. Letizia Tanca).
- 2012 - 2014 **Principal Investigator** (together with Prof. Marco Lovera) for the Department of Electronics and Information in the project SINOPIAE “Sistema prototipale multisorgente INtegrante tecniche di Osservazione multispettrale da satellite, aeromobile e a terra per il monitoraggio multi-scala della variazione di Indicatori ambientali legata ai costituenti Atmosferici e dispersione Energetica” funded by the Italian Ministry of University and Research and Regione Lombardia in the program “Progetti di Ricerca Industriale e Sviluppo Sperimentale per i settori strategici di Regione Lombardia”. (Scientific director for Politecnico di Milano Prof. Raffaella Brumana).
- 2012 - 2014 **Principal Investigator** for the Department of Electronics and Information in the project “Un Masterplan innovativo, aperto e digitale per gestire concretamente progetto Città Studi Campus Sostenibile” funded by Politecnico di Milano under the “5 per 1000” program. (Scientific director Prof. Alberto Longo).
- 2011 - 2013 **National Coordinator** of PRIN 2009 project “ROAMFREE: Robust Odometry Applying Multisensor Fusion to Reduce Estimation Errors” funded by the Italian Ministry of University and Research. (<http://roamfree.dei.polimi.it>).
- 2006 - 2009 **Project Coordinator** of the the sixth framework (FP6) project “RAWSEEDS: Robotics Advancement through Web-publishing of Sensorial and Elaborated Extensive Data Sets”. European Project FP6-045144. (<http://www.rawseeds.org>).
- 2007 - 2008 **Principal Investigator** grantee of “Brain-Computer Interfaces in Everyday Applications” grant by Politecnico di Milano and Regione Lombardia (within the joint program “Grant di Avvio alla Ricerca - Accordo di Collaborazione tra il Politecnico di Milano e la Regione Lombardia”).
- 2006 - 2008 **Investigator** in the Workpackage “Robotic Companion Exploiting Affective Feedback for Modeling Emotional State of the Patient and Adapting the Rehabilitation Treatment” of the IIT Funded Project on Rehabilitation within the Politecnico di Milano IIT Unit. (Scientific director of the workpackage Prof. Andrea Bonarini).
- 2003 - 2005 **Investigator** in the PRIN project MADSys “Sviluppo di metodologie e strumenti per lo sviluppo di comunità di agenti robotici” funded by the Italian Ministry of University and Research (MIUR). (Project coordinator Prof. Andrea Bonarini).
- 2002 - 2003 **Principal Investigator** (Grantee) of “Adattatività in ambienti dinamici tramite transductive learning e boosting” grant funded by the “Young Researcher” initiative at Politecnico di Milano.

Industrial Projects and Contracts

- 2018 **Principal Investigator** in the research project “Sistema di Acquisizione di Diagrammi Unifilari: definizione di architettura e specifiche del sistema di riconoscimento” with ABB.
- 2018 **Principal Investigator** in the research project “Studio sistema navigazione indoor basato su dispositivo DJI guidance” with ENI SPA and ENIProgetti (formerly Tecnomare).
- 2018 **Principal Investigator** in the research project “Studio ed identificazione delle architetture

- software per sistemi robotici, con particolare attenzione a ROS e OROCOS” with ENIProgetti (formerly Tecnomare).
- 2017 - 2018 **Investigator** in the research project “Studio di fattibilità per lo sviluppo di un drone per la ricerca di emissioni fuggitive” with ENIProgetti (formerly Tecnomare). (Principal investigator Prof. Marco Lovera)
- 2017 - 2018 **Investigator** in the research project “Attività di R&D sull’analisi e lo sviluppo di algoritmi e modelli predittivi per l’anticipazione di fenomeni associati a Non Productive Time nelle attività di perforazione Eni” with ENI SPA. (Principal investigator Prof. Luigi Piroddi)
- 2017 - 2018 **Principal Investigator** in the research project “Supporto nella progettazione e nello sviluppo di un sistema di guida autonoma per un veicolo elettrico autonomo” with Elettronica ASTER SPA.
- 2013 - 2018 **Principal Investigator** for Politecnico di Milano in the “Gara per l’affidamento di un appalto pre-commerciale ai sensi dell’art.19 co.1 lett. F) del D.LGS.N. 163/2016 relativo a servizi di ricerca industriale e sviluppo sperimentale funzionali alla realizzazione di un nuovo sistema universale per traino dei letti di degenza” with ARCA (Agenzia Regionale Centrali Acquisti) Regione Lombardia.
- 2015 - 2016 **Principal Investigator** in the research project “Realizzazione di una interfaccia cervello-computer basata su potenziale P300” with Infosolution SpA in the project “STELE: telemonitoraggio e autonomia nell’assistenza domiciliare dei pazienti di patologie neurodegenerative” funded by FILAS SpA.
- 2012 - 2013 **Principal Investigator** in the research project “Studio fattibilità software di programmazione off-line” with Gaiotto Automation SpA.
- 2010-2013 **Investigator** in the research contract “QUADRIVIO” with AEROSEKUR in the project “QUADRIVIO” funded by FILAS SpA. (Scientific director Prof. Gianantonio Magnani).
- 2010-2013 **Principal Investigator** in the research project “Realizzazione di una interfaccia cervello-computer basata su potenziale P300” with Infosolution SpA in the project “ON: monitoraggio e autonomia nella assistenza domiciliare dei pazienti affetti da SLA” funded by FILAS SpA.
- 2009-2013 **Investigator** in the workpackage “Intelligenza di prodotto” of project Industria 2015 n. EE01_00015 “Studio, progettazione e sviluppo di una nuova gamma di elettrodomestici caratterizzata da tecnologie innovative mirate a una notevole riduzione dei consumi energetici e dell’impatto ambientale” funded by Ministero dello Sviluppo Economico. (Scientific director of the workpackage prof. Andrea Bonarini).
- 2009-2012 **Investigator** in the research project “Metodi statistici e di machine learning per lo sviluppo automatico di ontologie di dominio” with Noustat S.r.l. (Scientific director prof. Andrea Bonarini).
- 2009-2010 **Investigator** in the research contract “Valutazione dell’efficacia della politica regionale di assegnazione agli E.E.L.L. di risorse finanziarie, in forme concertate, per interventi di sicurezza stradale e analisi dell’efficienza funzionale” funded by Regione Lombardia (Scientific director Prof. Lorenzo Mussone).

Professional Activities

- 04/2007 - 09/2007 Research Contract for the development of a Neural tool for sport engine diagnosis for an Italian Company (company name undisclosed for NDA clause).
- 12/2006 - 05/2007 Research Contract for consultancy on Emotion detection from biosignals for an Italian Research Center (company name undisclosed for NDA clause).
- 06/2000 - 09/2000 Special Research Contract: Ottimizzazione di paradigmi neurali per l’elaborazione di immagine, Politecnico di Milano, Department of Electronics and Information (Milan, Italy).
- 03/2000 - 04/2000 Special Research Contract: Progetto e prototipazione di un’architettura behavior based per robot autonomi, Politecnico di Milano, Department of Electronics and Information (Milan, Italy).
- 10/1999 - 11/1999 Special Research Contract: Sviluppo sistema per l’analisi di algoritmi di apprendimento ,

Autonomous systems are systems able to plan, perceive, and act, so to affect their surrounding environment without the need for human intervention. Classical examples are autonomous robots, unmanned vehicles, but also (ambient) assistive technologies where system autonomy is used to supply user deficits being either physical or cognitive. Out of the three activities of an autonomous system, perception is the main limiting factor for autonomous systems aiming at being deployed in the real world in a robust, adaptive, and reliable way.

My research in autonomous perception has focused on the use of techniques and models from Pattern Recognition, Machine Learning, Signal Processing, and Dynamic State Estimation for dealing with uncertainty in perception so to allow autonomous systems to perceive their environment effectively (i.e., being able to cope with sensor uncertainty and incomplete knowledge). In doing this, three real-world scenarios have been investigated: environment perception from an autonomous robot, user state/intent perception by an autonomous system, perception of the environment by a set of distributed sensors.

In the following the results of my research in autonomous system perception and intelligent data analysis, also known as machine learning, are described together with their current and future research perspective; selected references to relevant publications are given while the full list of my publications is reported afterwards.

Research Achievements, Results, and Products

MRT: the Milan RoboCup Team

From 2001 to 2009, after graduation, I participated to the Milan Robocup Team (MRT - <http://robocup.elet.polimi.it/MRT/>) a Robocup (<http://www.robocup.org/>) team of six autonomous soccer robots; my contribution in terms of algorithms and models was related to custom panoramic vision sensors [B12], adaptive color classification algorithms [B11][B7], and a conceptual model to integrate robot perception with information from teammates based on fuzzy logic [A8][A5]. The behavior of the robots was implemented using BRIAN, a system able to manage the interaction among fuzzy behavioral modules, which I designed at the beginning of my PhD [A2]. This research gave me the opportunity to develop and verify “on the field” the technologies and methodologies I developed to make perception algorithms able to deal with dynamic and non stationary environments. To cope with the complexity of designing and maintaining a team of robots, I worked at the design of the message oriented middleware “Device Communities Development Toolkit” (DCDT) [B13][D5], which has been used to program the MRT robots. After the RoboCup experience, and because of it, I pursued research in developing modular and flexible tools and methodologies for the rapid prototyping of low-cost (service) robots. The last result is Rapid Robot Prototyping (R2P), a framework for the programming and integration of embedded systems in robotics (e.g., motor control board, inertial measurement unit, sonar sensors, etc.), which sports a publish/subscribe communication paradigm integrated over the CAN fieldbus [A27]. Beside being an effective design methodology, as testified by the different robot realized with it, R2P is currently at a mature stage and we are now planning to present it as a commercial open source project. In 2015, based on the outcome of the research on the Robot Rapid Prototyping framework a Spin-off has been founded, namely Nova Labs, for the commercialization and the customization of the Robot Rapid Prototyping tools. My research on modular and component based robotics has now moved to the software aspects of complex systems leveraging the tool of model based development [A46].

LURCH: an Autonomous Wheelchair with Multimodal Interfaces

In 2007 I started the LURCH project for the development of an autonomous wheelchair, which could help people unable to move autonomously [B17]. This effort has resulted in an autonomous wheelchair, which

sports the “shared autonomy” design paradigm: depending on the needs of the user, the robot supplies the needed autonomy from simple safety enhancer up to fully autonomous vehicle [D100]. Having the user at the center of the robot design, beside the capabilities needed for autonomous operation, I decided to design several human computer interfaces for the autonomous wheelchair ranging from the simple ones (e.g., touch screen GUI or electromyographic sensor) to the most innovative ones (e.g., a Brain Computer Interface based on Event Related Potentials) [D56]. The project has reached the maturity of an industrial prototype and this has been recognized by the two prizes (Antonio D’Auria SIRI Prize and Intesa San Paolo “Startup Initiative” award) obtained by its RobyWheelChair industrial counterpart developed together with the industrial partner Infosolution SpA. The competences built during the development of LURCH prototype have been the base for the project “ALMA: Aging without Losing Mobility and Autonomy” aimed at deploying two autonomous wheelchairs in real scenarios and at finalizing an industrial prototype (funded under the European Ambient Assisted Living (AAL) Joint Program). The LURCH prototype in now become a more mature product named Personal Mobility Kit (PMK) demonstrated in several public events.

Simultaneous Localization and Mapping in Autonomous Robots and Unmanned Vehicles

In the field of incremental building of maps and localization for autonomous robots in unknown environments I worked, in cooperation with Università degli Studi di Milano - Bicocca, on the development of a complete SLAM (i.e., Simultaneous Localization and Mapping) system in six degrees of freedom based on trinocular and monocular vision sporting hierarchical map decomposition [D46][D34][D35]. In particular, I applied my background in statistics and modeling to the various aspects of localization, simultaneous localization and mapping, and data association with specific interests in error modeling [D88][D71][D61]. Then I worked on a Visual SLAM system with multiple cameras able to build large scale visual maps (hundreds of meters, thousands of features) in real-time based on the Conditional Independence SLAM technique [A28]. This Visual SLAM system has then been combined with other odometric estimates through the ROAMFREE framework, a methodology we developed to perform multi odometric sensor fusion (e.g., inertial measurement units, laser range finder, single and multiple camera systems, etc.), to obtain an accurate and robust perception of the robot path [D104]. The resulting system has been deployed on the indoor robots at the AIRLab (e.g., the autonomous wheelchair LURCH), and in outdoor unmanned vehicles such as the QUADRIVIO all terrain robot at MERLIN (MERLIN (MEchatronics and Robotics Laboratory for INnovation - Politecnico di Milano) [D99].

Benchmarking and Good Experimental Methodologies in Autonomous Robots

The development of novel methods and techniques in intelligent systems needs a proper methodology for the evaluation of real advancements in research; however, the field of Benchmarking and Good Experimental Methodologies in Robotics is still in its infancy. I have been actively involved in the design of suitable benchmarks and good experimental methodologies for intelligent systems, in particular, for the benchmarking of Simultaneous Localization and Mapping systems through the coordination of the FP6-045144 European project RAWSEEDS for the creation of a Multi Sensor Benchmark for Simultaneous Localization and Mapping (www.rawseeds.org) [A10][B18][D38]. Since its constitution I have been part of the Euron Special Interest Group on Good Experimental Methodologies and Benchmarking (GEM SIG) and I worked on the writing of the “*General Guidelines for Robotics Papers Involving Experiments*” for the chapter regarding papers on “*Simultaneous Localization And Mapping*” (www.heronrobots.com). I participated as External Expert to the FP7 RoSta (Robot Standards) project in the benchmarking workpackage (wiki.robot-standards.org), and I have been Politecnico di Milano Principal Investigator for the FP7-ICT-601012 European project RoCKIn (www.rockinrobotchallenge.eu) for the design and execution of two international competitions for the benchmarking of autonomous robots in the home environment (RoCKIn@Home) and at work (RoCKIn@Work). I have been part of the IEEE RAS Standard Group which has defined IEEE P1873/D1 Standard for Robot Map Data Representation for Navigation [A49], and founder member of the euRobotics AISBL (the Private counterpart of the Robotics PPP being the European Commission the Public one) Topic Group on “Evaluation of Research Results: Result Replication,

Benchmarking, Challenges and Competitions”. This research field on good experimental methodologies in robotics has recently been at the center of the Horizon 2020 ICT Call on Robotics and I have been invited by a EC Project Officer to give a talk at a Workshop at the European Robotics Forum on “*Benchmarking in Robotics: Challenges and Visions*” to share my past experience.

P300 + ErrP BCI: a Self-Correcting Brain-Computer Interface

While developing the autonomous wheelchair LURCH, lot of effort has been directed to the development of effective human robot interfaces, the most challenging one being an Event Related Brain-Computer Interface. In the years from 2007 to 2009 I studied an interface able to capture the user intent from brain activity so to transfer this intent to the autonomous wheelchair or to enable people suffering severe pathologies (e.g., Amyotrophic Lateral Sclerosis) to communicate. The result of this research activity has been the first Brain Computer Interface integrating the classical P300 event related potential and the ErrP error potential [A25][A13]. In the winter of 2009 this BCI was used to control the autonomous wheelchair and this had quite resonance on the press (<http://airwiki.elet.polimi.it/index.php/MediaCoverage>). To evaluate the effectivity of this novel self-correcting paradigm I have worked on a novel metric for the performance evaluation of a Brain-Computer Interface [A16][A32], which could be applied as a methodology for the evaluation of pattern recognition based interfaces used as assistive devices (e.g., gesture recognition), and to be used within the design cycle of a machine-user interface based on pattern recognition. In the past I was already involved in the development of communication systems for disabled people applying machine learning techniques for developing symbolic language prediction models for Alternative and Augmentative Communication [B8][B5] so I have applied these techniques also to the Brain-Computer Interface field in order increase the effectiveness of a Motor Imagery Brain-Computer Interface [A22].

Bioinformatics, Biosignal Interpretation, and Affective Computing

Beside clinical and end-user involvement (e.g., Ospedale S. Camillo di Venezia, Policlinico di Roma), my research activity on Brain-Computer Interfaces has been conducted in collaboration with researchers from the (former) Bioengineering Department of Politecnico di Milano and this gave birth to a series of fruitful collaborations on biosignal interpretations too. In particular I have contributed with my expertise in machine learning and pattern recognition to the development of algorithms for the detection of Obstructive Sleep Apnea [A14][A12] and the classification of sleep stages [A15] from ECG signals. My experience on EEG signal analysis (from Brain-Computer Interface research) has been applied also to the development of an automated technique for the detection of Cyclic Alternating Patterns in sleep [A23][A20]. Out of these collaborations, came my interest in Affective Computing, i.e., the study and development of systems and devices that can recognize, interpret, process, and simulate human affects [D92][D77]. The research on this field has lead two of my PhD students in starting up a company, Empatica S.r.l. (www.empatica.com), which produces a portable device (wristband) for the detection of user stress and emotions. In this field I have been mostly interested in the methodological aspects of experiment design and validation in affective computing experiments [D90]. More recently I have been involved by the research group on genomic Computing of Politecnico di Milano in applying machine learning techniques to genomic data, so far our research has led to international publications on signal processing [A42], data visualization [A45], and efficient data handling and indexing [A44].

VeTRA: a Model-based Multi Camera Vehicle Tracking System

Since 2008 I have been interested in visual tracking and user behaviour analysis. Beside specific advancements in background subtraction [A29][D36], the most relevant result is the development of VeTRA, a visual tracking system composed of multiple synchronized cameras for the analysis and the 3D reconstruction of vehicle traffic in roundabout intersections [A30]. VeTRA is able to reconstruct the 3D trajectory of vehicles, their type and their dimensions; the system has been evaluated on real data collected

during a field survey for the evaluation of the roundabout effectiveness on behalf of Regione Lombardia. VeTRA is one of the tools developed within a methodology for the evaluation of the effectiveness of different road intersections in a transport system design [A26][A24].

Geometry of Information in Estimation of Distribution Algorithms

Because of my background in statistics I have always used tools from Bayesian inference in autonomous systems perception and intelligent data analysis. I also applied those tools to Genetic Algorithms by proposing a Bayesian extension to Learning Classifier Systems in dealing with uncertainty [D32]. That is why I immediately found myself intrigued by the Estimation of Distribution Algorithm (EDA) approach in evolutionary computation. Because of their use of directed and undirected graphical models from Statistics EDAs allow a principled theoretical analysis of the way optimization is performed in this class of evolutionary algorithms. With a colleague from the Mathematics Department of Politecnico di Torino and a co-tutored PhD Student we have proved some theorems on the (Information) Geometry of Estimation Distribution Algorithms based on models from the exponential family [D72][D81] and their relationship with natural gradient descent and Gibbs samplers [D106]. This highly theoretical work has nevertheless lead to novel techniques in the Estimation of Distribution Algorithm field capable of learning the models to be exploited in the optimization process by leveraging on their Information Geometry properties [D97][D93].

Invited Talks and Papers

- Invited talk titled “Cosa intendiamo per IA ... tutto ciò che avreste voluto sapere e non avete mai osato chiedere.” at Convegno “INTELLIGENZA ARTIFICIALE E RICERCA CLINICA”, Milan, 18th of September 2018 <https://www.advicepharma.com/intelligenza-artificiale-e-ricerca-clinica/>
- Invited talk titled “A che punto siamo con le tecnologie dell’AI e il loro futuro possibile” at Convegno “AI TECH CONFERENCE: Artificial Intelligence per le imprese e per un mondo migliore”, Milan, 5th of July 2018
- Invited talk titled “Sul senso (comune) dei Big Data” at Convegno “Big Data e Robotica nella fabbrica digitale connesso”, Milan, 30th of November 2017
- Invited talk titled “AI and Cognitive Technology: Why, What, How ...” at the Cognitech Conference, Milan, 29th of March 2017
- Invited talk titled “*The RAWSEEDS Project: How we did it!*” at the CHIST-ERA Conference on “Object recognition and manipulation by robots: Data sharing and experiment reproducibility”, Krakov, 21st of June 2017
- Invited talk titled “*Modular development of service robots: from Rapid Robot Prototyping to Nova Core*” in the Sessione Specialistica “Robot & Co.” at A&T 2016, Torino, 21st of April 2016
- Invited talk titled “*Do Big Data make (common) sense?*” at Convegno “L’automazione nell’era dei Big Data: scenari e prospettive”, at MECSPE, Parma, 18th of March 2016
- Invited talk titled “*Do we really need to replicate experiments?*” in the “Open forum on evaluation of results, replication of experiments and benchmarking in robotics research” at the 2015 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS 2015), on 28th of September 2015
- Invited talk titled “*The RAWSEEDS Project: How we did it!*” at the 2015 IEEE-RAS Summer School on Experimental Methodology, Performance Evaluation and Benchmarking in Robotics on 15th of September 2015
- Invited talk titled “*Benchmarking and Competitions*” at the 2015 IEEE-RAS Summer School on Experimental Methodology, Performance Evaluation and Benchmarking in Robotics on 15th of September 2015
- Invited presentation titled “*RoCKIn: Driving Robotics Forward through Collaboration, Benchmarking and Competition*” in the Forum on “Robotics Challenges and Competitions” at the 2014 IEEE International Conference on Robotics and Automation (ICRA 2014), on 4th of June 2014.

- Invited presentation titled “*Benchmarking in Robotics: Challenges and Visions*” in the Workshop “Shared infrastructures, benchmarking and performance evaluation” at the 2014 European Robotics Forum (ERF) on 12th of March 2014.
- Invited presentation titled “*Benchmarking through competitions*” to the EuRoC Challenge Design Workshop on 23rd of January 2014.
- Invited presentation titled “*The Utility Metric*” to the Workshop on “BCI Performance Metrics” held during the 5th International BCI Meeting from June 3rd - June 7th, 2013. Submitted to the Journal of Neural Engineering as part of the contribution “Performance Measurement for Brain-Computer or Brain-Machine Interfaces: A Tutorial”.
- Invited seminar (26/01/2012) “*Integrating P300 and Error Potentials in a Single BCI: Algorithms, Techniques & Performance Assessment*” in the seminar program “Bioengineering Seminar Series” at the Department of Bioengineering of Politecnico di Milano
- Invited paper at the 18th World Congress of International Federation of Automatic Control “*On Feature Parameterization for EKF-based Monocular SLAM*”, in the Special Session on SLAM
- Invited paper at the 5th Symposium on Intelligent Autonomous Vehicle “*A model to manage data reliability in behavior-based robotics*”.

Full List of Publications

A. Articles in International Journals

- A51. Vahid Jalili, Matteo Matteucci, Jeremy Goecks, Yashar Deldjoo, Stefano Ceri. “*Next Generation Indexing for Genomic Intervals*”. IEEE Transactions on Knowledge and Data Engineering, doi: 10.1109/TKDE.2018.2871031, 2018.
- A50. Gianluca Bardaro, Luca Bascetta, Marcello Farina, Matteo Matteucci. “*MPC-based control architecture of an autonomous wheelchair for indoor environments*”. Control Engineering Practice, vol.78, p.160-174. 2018.
- A49. Francesco Amigoni, Wonpil Yu, Torsten Andre, Dirk Holz, Martin Magnusson, Matteo Matteucci, Hyungpil Moon, Masashi Yokozuka, Geoffrey Biggs, Raj Madhavan. “*A Standard for Map Data Representation: IEEE 1873-2015 Facilitates Interoperability Between Robots*”. IEEE Robotics and Automation Magazine, vol. PP, p. 1-13, ISSN: 1070-9932, doi: 10.1109/MRA.2017.2746179. 2018.
- A48. Fabio Veronese, Andrea Masciadri, Sara Comai, Matteo Matteucci, Fabio Salice. “*Behavior Drift Detection Based on Anomalies Identification in Home Living Quantitative Indicators*”. Technologies, vol. 6, p. 1-15, ISSN: 2227-7080, doi: 10.3390/technologies6010016. 2018.
- A47. Enrico Piazza, Andrea Romanoni, Matteo Matteucci. “*Real-Time CPU-Based Large-Scale Three-Dimensional Mesh Reconstruction*”. IEEE Robotics and Automation Letters, vol. 3, p. 1584-1591, ISSN: 2377-3766, doi: 10.1109/LRA.2018.2800104. 2018.
- A46. Gianluca Bardaro, Andrea Semperebon, Matteo Matteucci. “*AADL for robotics: a general approach for system architecture modeling and code generation*”. Journal of Software Engineering in Robotics, vol. 8, p. 32-44, ISSN: 2035-3928. 2017.
- A45. Vahid Jalili, Matteo Matteucci, Marco Masseroli, Stefano Ceri. “*Explorative visual analytics on interval-based genomic data and their metadata*”. BMC BIOINFORMATICS, vol. 18, p. 1-15, ISSN: 1471-2105, doi: 10.1186/s12859-017-1945-9. 2017.
- A44. Vahid Jalili, Matteo Matteucci, Marco Masseroli, Stefano Ceri. “*Indexing Next-Generation Sequencing data*”. Information Sciences, vol. 384, p. 90-109, ISSN: 0020-0255, doi: 10.1016/j.ins.2016.08.085. 2017.
- A43. Sara Comai, Emanuele De Bernardi, Matteo Matteucci, Fabio Salice. “*Maps for Easy Paths (MEP): Accessible Paths Tracking and Reconstruction*”. EAI Endorsed Transactions on Internet of Things, vol.3, p.1-10, ISSN: 2414-1399, doi: 10.4108/eai.31-8-2017.153050. 2017.
- A42. Vahid Jalili, Matteo Matteucci, Marco J. Morelli, Marco Masseroli. “*MuSERA: Multiple sample enriched region assessment*”. Briefings in Bioinformatics, vol.18, p.367-381, ISSN: 1467-5463, doi: 10.1093/bib/bbw029. 2017.

- A41. Fabio Veronese, Andrea Masciadri, Anna A. Trofimova, Matteo Matteucci, Fabio Salice. *“Realistic human behaviour simulation for quantitative ambient intelligence studies”*. Technology and Disability, vol. 28, p. 159-177, ISSN: 1055-4181, doi: 10.3233/TAD-160453. 2017.
- A40. Giulio Vitale, Andrea Bonarini, Matteo Matteucci, Luca Bascetta. *“Toward vocational robotics”*. IEEE Robotics and Automation Magazine, vol. 23, p. 73-81, ISSN: 1070-9932, doi: 10.1109/MRA.2016.2571998. 2016.
- A39. Simone Mangano, Hassan Saidinejad, Fabio Veronese, Sara Comai, Matteo Matteucci, Fabio Salice. *“Bridge: Mutual Reassurance for Autonomous and Independent Living”*. IEEE INTELLIGENT SYSTEMS - ISSN:1541-1672 vol. 30 (4), pp.31-38. DOI:10.1109/MIS.2015.58. 2015.
- A38. Francesco Amigoni, Emanuele Bastianelli, Jakob Berghofer, Andrea Bonarini, Giulio Fontana, Nico Hochgeschwender, Luca Iocchi, Gerhard K. Kraetzschmar, Pedro Lima, Matteo Matteucci, Pedro Miraldo, Daniele Nardi, Viola Schiaffonati. *“Competitions for Benchmarking. Task and Functionality Scoring Complete Performance Assessment”*. IEEE Robotics and Automation Magazine ISSN:1070-9932 vol. 22 (3) pp.53-61. DOI:10.1109/MRA.2015.2448871. 2015.
- A37. Andrea Romanoni, Domenico G. Sorrenti, Matteo Matteucci. *“Backward-Simulation Particle Smoother with a hybrid state for 3D vehicle trajectory, class and dimension simultaneous estimation”*. Machine Vision and Applications, Volume 26(2-3):369-385, Springer Berlin Heidelberg, 2015. DOI:[10.1007/s00138-015-0668-z](https://doi.org/10.1007/s00138-015-0668-z)
- A36. Jalili Vahid, Matteo Matteucci, Marco Masseroli, Marco J. Morelli. *“Using combined evidence from replicates to evaluate ChIP-seq peaks”*. BIOINFORMATICS - ISSN:1367-4803 vol. 31 (17), pp. 2761-2769. DOI:10.1093/bioinformatics/btv293. 2015.
- A35. Adnan Tahirovic, Matteo Matteucci, Luca T Mainardi. *“An Averaging Technique for the P300 Spatial Distribution”*. Methods of Information in Medicine, Volume 54(3):215-220, Schattauer Publishers, 2015. DOI:[10.3414/ME13-02-0037](https://doi.org/10.3414/ME13-02-0037)
- A34. Gianpaolo Cugola, Alessandro Margara, Matteo Matteucci, Giordano Tamburrelli. *“Introducing Uncertainty in Complex Event Processing: Model, Implementation, and Validation”*. Computing, Volume 97(2):103-144, Springer Vienna, 2015. (First published online 4th May 2014). DOI:[10.1007/s00607-014-0404-y](https://doi.org/10.1007/s00607-014-0404-y)
- A33. Andrea Romanoni, Lorenzo Mussone, Davide Rizzi, Matteo Matteucci. *“A comparison of two Monte Carlo algorithms for 3D vehicle trajectory reconstruction in roundabouts”*, Pattern Recognition letters, Volume 51:79-85, January 2015, DOI: 10.1016/j.patrec.2014.09.003
- A32. Davide Antonio Cucci, Matteo Matteucci. *“On the Development of a Generic Multi-Sensor Fusion Framework for Robust Odometry Estimation”*. Journal of Software Engineering for Robotics (JOSER), Special Issue on “Best Practice in Robotic Software Development”, Volume 5(1):48-62, ISSN 2035-3928, 2014.
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- A30. Lorenzo Mussone, Matteo Matteucci, Marco Bassani, and Davide Rizzi. *“An innovative method for the analysis of vehicle movements in roundabouts based on image processing”*. Journal of Advanced Transportation 47(6):581–594, 2013. DOI: [10.1002/atr.184](https://doi.org/10.1002/atr.184)
- A29. Andrea Romanoni, Matteo Matteucci, Domenico G Sorrenti. *“Background subtraction by combining Temporal and Spatio-Temporal histograms in the presence of camera movement”*. Machine Vision and Application, DOI:[10.1007/s00138-013-0587-9](https://doi.org/10.1007/s00138-013-0587-9). 25(6):1573-1584. Springer Berlin Heidelberg, 2014 (Published online digitally on 08 December 2013, ISSN 1432-1769)
- A28. Simone Ceriani, Daniele Marzorati, Matteo Matteucci and Domenico G Sorrenti. *“Single and Multi Camera Simultaneous Localization and Mapping Using the Extended Kalman Filter”*. Journal of Mathematical Modelling and Algorithms in Operations Research, Volume 13(1):23-57, ISSN: 2214-2487, Springer Netherlands, 2014 (Published online in 2013). DOI 10.1007/s10852-013-9219-7
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- A26. Matteo Matteucci, Lorenzo Mussone. "An ant colony system for transportation user equilibrium analysis in congested networks". *Swarm Intelligence*, Volume 7(4):255-277, ISSN 1935-3812, Springer, 2013. DOI 10.1007/s11721-013-0083-x.
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- A18. Federico Maggi, Matteo Matteucci, Stefano Zanero. "Detecting Intrusions through System Call Sequence and Argument Analysis". *IEEE Transactions on Dependable and Secure Computing*. Volume 7(4):381-395, ISSN 1545-5971, 2010. DOI 10.1109/TDSC.2008.69.
- A17. Juha M Kortelainen, Martin O Mendez, Anna Maria Bianchi, Matteo Matteucci, and Sergio Cerutti. "Sleep Staging based on Signals Acquired through Bed Sensor". *IEEE Transactions on Information Technology in Biomedicine* 14(3):776-785, 2010.
- A16. Bernardo Dal Seno, Matteo Matteucci, Luca T Mainardi. "The Utility Metric: A Novel Method to Assess the Overall Performance of Discrete Brain-Computer Interfaces". *IEEE Transactions on Neural Systems and Rehabilitation Engineering*, Volume 18(1):20-28, ISSN 1534-4320, 2010. DOI 10.1109/TNSRE.2009.2032642.
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- A13. Bernardo Dal Seno, Matteo Matteucci, and Luca T Mainardi. "Online Detection of P300 and Error Potentials in a BCI Speller". *Computational Intelligence and Neuroscience* (Article ID 307254), 2010.
- A12. Martin O Mendez, Anna Maria Bianchi, Matteo Matteucci, Sergio Cerutti, and Thomas Penzel. "Sleep Apnea Screening by Autoregressive Models From a Single ECG Lead". *IEEE Transactions on Biomedical Engineering* 56(12):2838-2850, ISSN 0018-9294, 2009. DOI 10.1109/TBME.2009.2029563.
- A11. Federico Maggi, Matteo Matteucci and Stefano Zanero. "Reducing false positives in anomaly

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- A10. Simone Ceriani, Giulio Fontana, Alessandro Giusti, Daniele Marzorati, Matteo Matteucci, Davide Migliore, Davide Rizzi, Domenico G Sorrenti, Pierluigi Taddei. "*Rawseeds ground truth collection systems for indoor self-localization and mapping*". Autonomous Robots, Volume 27(4):353--371, ISSN 1573-7527, 2009. DOI 10.1007/s10514-009-9156-5.
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- A8. Andrea Bonarini, Matteo Matteucci, and Marcello Restelli. "*Problems and solutions for anchoring in multi-robot applications*". Journal of Intelligent and Fuzzy Systems 8(3):245-254, 2007.
- A7. Andrea Bonarini, Matteo Matteucci, Marcello Restelli. "*Learning Fuzzy Classifier Systems: Architecture and Exploration Issues*". International Journal on Artificial Intelligence Tools 16(2):269--289, 2007.
- A6. Valentino DA Corino, Matteo Matteucci, and Luca T Mainardi. "*Analysis of Heart Rate Variability to Predict Patient Age in a Healthy Population*". Methods of Information in Medicine (2010):191-195, 2007.
- A5. Andrea Bonarini, Matteo Matteucci, and Marcello Restelli. "*Concepts and Fuzzy Models for Behavior-Based Robotics*". International Journal of Approximate Reasoning, Volume 41(2):110-127, ISSN 0888-613X Jan., 2006. DOI 10.1016/j.ijar.2005.06.017.
- A4. Valentina D A Corino, Matteo Matteucci, Luca Cravello, Ettore Ferrari, Antonio A Ferrari, and Luca T Mainardi. "*Long-term heart rate variability as a predictor of patient age*". Computer Methods and Programs in Biomedicine 82(3):248-257, 2006.
- A3. Matteo Matteucci, and Dario Spadoni. "*Evolutionary learning of rich neural networks in the Bayesian model selection framework*". International Journal of Applied Mathematics and Computer Science 14(3):423-440, 2004.
- A2. Andrea Bonarini, Giovanni Invernizzi, Thomas Halva Labella, and Matteo Matteucci. "*An architecture to coordinate fuzzy behaviors to control an autonomous robot*". Fuzzy sets and systems, Volume 134:101-115, ISSN 0165-0114, February, Elsevier, 2003. DOI 10.1016/S0165-0114(02)00232-4
- A1. Andrea Bonarini, Claudio Bonacina, Matteo Matteucci. "*An approach to the design of reinforcement functions in real world, agent-based applications*". IEEE Transactions on Systems, Man, and Cybernetics, Part B, Volume 31(3):288--301, ISSN 1083-4419 June, 2001. DOI 10.1109/3477.931510.

B. Articles and Chapters in International Books

- B26. Sara Comai, Emanuele De Bernardi, Andrea Masciadri, Matteo Matteucci, Fabio Salice, Fabio Veronese. "*ALMA: An Indoor Localization and Navigation System for the Elderly*". In: (a cura di): Barbara Guidi Laura Ricci Carlos Calafate Ombretta Gaggi Johann Marquez-Barja, Smart Objects and Technologies for Social Good. p. 82-91, Springer, ISBN: 978-3-319-76110-7, doi: 10.1007/978-3-319-76111-4_9. 2018
- B25. Andrea Masciadri, Anna A. Trofimova, Matteo Matteucci, Fabio Salice. "*Human Behavior Drift Detection in a Smart Home Environment*". In: (a cura di): Peter Cudd Luc de Witte, Studies in Health Technology and Informatics. p. 199-203, Nieuwe Hemweg 6B:IOS Press, ISBN: 9781614997979, doi: 10.3233/978-1-61499-798-6-199. 2017
- B24. Fabio Veronese, Andrea Masciadri, Sara Comai, Matteo Matteucci, Fabio Salice. "*Quantitative Indicators for Behaviour Drift Detection from Home Automation Data*". In: (a cura di): P. Cudd L. de Witte, Studies in Health Technology and Informatics. p. 208-215, Nieuwe Hemweg 6B:IOS Press, ISBN: 9781614997979, doi: 10.3233/978-1-61499-798-6-208. 2017
- B23. Ludovico Biagi, Sara Comai, Raffaella Mangiarotti, Matteo Matteucci, Marco Negretti, Secil Ugur Yavuz. "*Enriching Geographic Maps with Accessible Paths Derived from Implicit Mobile Device Data Collection*". In: (a cura di): Shin'ichi Konomi (University of Tokyo Japan) and George Roussos (University of London UK), Enriching Urban Spaces with Ambient Computing, the Internet of Things,

- and Smart City Design. p. 89-113, IGI Global, ISBN: 9781522508274, doi: 10.4018/978-1-5225-0827-4.ch005. 2016.
- B22. Sara Comai, Daniel Kayange, Raffaella Mangiarotti, Matteo Matteucci, Secil Ugur Yavuz, Francesco Valentini. *"Mapping City Accessibility: Review and Analysis"*. In: (a cura di): Cecilia Sik-Lányi Evert-Jan Hoogerwerf Klaus Miesenberger Peter Cudd, Assistive Technologies. p. 325-331, IOS Press, ISBN: 978-1-61499-565-4, doi: 10.3233/978-1-61499-566-1-325. 2015
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- B16. Davide Eynard, Matteo Matteucci, Fabio Marfia. *"A Modular Framework to Learn Seed Ontologies from Text"*. *Semi-Automatic Ontology Development: Processes and Resources*. Editors Maria Teresa Pazienza, and Armando Stellato. pp. 22-47. Information Science Reference. 2012.
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- B14. Davide Migliore, Matteo Matteucci and Pier Paolo Campari. *"Improving Geodesic Invariant Descriptors through Color Information"*. *Computer Vision and Computer Graphics. Theory and Applications* 24:148-161, 2009.
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