

Curriculum Vitae

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1 Executive Summary

Current position. Since 2016 I am an *Associate Teaching Professor* at the Department of Computer Science of the *Carnegie Mellon University*. My teaching and research activities are in the *CMU campus of Education city, in Doha (Qatar)*, with a focus on *AI, ML, robotics, and algorithms*. At CMU Qatar *teaching* is, by contract, my first priority. Therefore, in the last 5 years most of my time has been devoted to professionally prepare and deliver courses (between 3 and 4 per year), including lectures, homework, and recitations, and continually support student learning and professional development. Nevertheless, being a true passionate researcher, I've been putting all available extra time and efforts to keep doing research, achieving good results (4 journal and 10 conference co-authored contributions in top-quality venues, 2 project grants), but producing a quite lower amount of scientific output compared to the years before joining CMU.

Past academic positions. Before joining CMU, I have been Senior researcher at the *Dalle Molle Institute for Artificial Intelligence (IDSIA)* in Lugano, Switzerland (2003-2016); post-doctoral Marie Curie fellow at *CoDE-IRIDIA*, the AI research laboratory of the Université Libre de Bruxelles (ULB) in Belgium (1996-1999, 2001-2003); EU Science & Technology in Japan fellow at the *Advanced Telecommunications Research International (ATR)* institute, in Kyoto, Japan (1999-2001); research associate at the *Department of Mathematics, University of Trento*, Italy (1995); research fellow at the *Istituto per la Ricerca Scientifica e Tecnologica (IRST)*, in Trento, Italy (1993-1994); research associate at the *Universities of Bologna and Modena*, Italy (1992, 1993, 1996).

Education. I hold a *Laurea* degree in *physics*, *summa cum laude*, from the University of Bologna, Italy (1992), with a thesis on the design and implementation of a parallel system for online data acquisition and analysis in experimental particle physics. In 2001 I obtained a *Diplôme d'Études Approfondies (D.E.A.)* from the ULB, in Belgium, with a thesis on the design and use of ant-like agents for adaptive routing in networks. In 2004 I've got with full honors a *Ph.D. in Applied Sciences* from the ULB, under the supervision of Prof. Marco Dorigo (FNRS & CoDe-IRIDIA). The thesis gave the formal foundations of the Ant Colony Optimization (ACO) metaheuristic, defined its relationships with Markov Decision Processes and Reinforcement Learning, and presented its application to routing problems in dynamic networks, both wired and mobile ad hoc.

Expertise and Impact. My professional background is strongly inter- and multi-disciplinary. In particular, my expertise and interests include *artificial intelligence, machine learning, swarm robotics and swarm intelligence, autonomous robotics, multi-robot systems, human-robot interaction, optimization, sensor and mobile ad hoc networking, bio-inspired computing, parallel and distributed systems*. In these domains I co-authored or co-edited more than *160 scientific publications* that, according to Google Scholar, have resulted in more than *34,400 citations* with *h-index 42*.

Recent research. Recently published work and invited talks include: (i) formulation and solution algorithms for mission planning in heterogeneous multi-agent systems tackling spatially distributed tasks and multiple constraints [1]; (ii) survey and analysis of swarm intelligence for design and control of large-scale cyber-physical systems [2]; (iii) data map learning via distributed planning and adaptive region-based Bayesian sampling in multi-robot systems [3, 4, 5]; (iv) formulation and distributed solution of the problem of fair tracking of multiple moving targets using a (smaller) robot team [6]; (v) survey and analysis of methods of ML for combinatorial optimization [7]; (vi) human-in-the-loop: survey of models and techniques in human-swarm interaction, use of sporadic and imprecise verbal inputs to help robot navigation, use of multimodal interfaces for mixed initiative systems [8, 9, 10, 11]; (vii) modeling artificial emotions for behavior-modulation and implicit coordination in multi-robot systems [12]; (viii) deep learning for vision-based safe navigation of a flying robot in a forest [13].

Teaching. Teaching is a central component of my professional mission. By contract, teaching is my *first priority at CMU Qatar*. I have a good experience in teaching, having been regularly involved in providing university courses at both undergraduate and graduate level since 2008 in CS and engineering departments. My teaching portfolio includes courses on *AI, Machine learning, Operations research, Robotics, Optimization, Collective intelligence, Programming, Algorithms*. At CMU-Q I have focused on extensively providing introductory courses to AI, ML, robotics, and programming. In addition, I have also designed and successfully delivered new courses in these same domains (15-288 Machine learning in a nutshell, 15-382 Collective intelligence). In my courses I always target to achieve a satisfactory balance between theory and practice, integrating theory lectures with weekly homework and interactive labs and recitations. Over the years, I've incrementally prepared and revised accessible and informative didactic material for the students in the form of slides, technical notes, python notebooks, short videos (e.g., web2.qatar.cmu.edu/~gdicaro/15288/, web2.qatar.cmu.edu/~gdicaro/15281/).

Outreaching. In addition to teaching to university students, at CMU-Q I've also been extensively involved in the design and delivery of multiple *outreach workshops* aimed to expose high-school students to computational problem-solving, python programming, and robotics, in an accessible and engaging manner.

Student advising. Supporting and advising student formation and research is also a priority. So far, I have been involved as an advisor in 2 Ph.D. thesis, and in more than 20 student research works, including theses of various levels, internships, summer projects, independent studies. I’m currently the advisor of three QSIURP-funded student projects in the domains of AI/ML, that are just started. I’ve also been in the Ph.D. committee of two theses at CMU and the external examiner of five theses.

Professional service. In the past I’ve been particularly active participating in or leading the organization of conferences and workshops, being involved in at least 11 major international events, mostly in the domains of swarm intelligence, bio-inspired computing, and networking. In more recent times, I decided to step back and focus more on other activities. I also co-edited 4 *journal special issues*, the last one, on *Machine learning and combinatorial optimization* is being published on the prestigious *OR Spectrum* journal.

Grant support. To support my research, I’m actively involved in *collaborative research projects* and in the preparation of *project proposals* for funding. My research projects revolve around the use and the synergistic integration of AI, ML, multi-robot/swarm systems, networking, and optimization, to tackle the challenges of important real-world problem scenarios. Currently, I’m the LPI of NPRP-10 project *TARMEM: Teams of Aquatic/Aerial Robots for Marine Environmental Monitoring* (2018–2021, 600k USD), and of UREP-27 project *Communications-aware distributed deep reinforcement learning in multi-robot teams for underwater inspection tasks* (2021–2022), both funded by the Qatar National Research Fund (QNRF). Also (as LPI and PI) I’ve recently submitted three collaborative research proposals to QNRF for funding (1.6M USD). Proposals address, respectively, AI in education, precision agriculture, and collection of plastic waste in the sea. Research topics include deep learning with multi-spectral images, learning from time-series, non-stationary regression models, planning in multi-robot teams.

In the past, I’ve been the LPI of project *ALMA: Ageing without Losing Mobility and Autonomy* (2013–2016), funded for a total of 3.5M EUR (for 9 partners) under the Ambient Assisted Living (AAL) EU program. As a co-PI I’ve been involved in Swiss- and EU-funded projects related to human-robot interaction, swarm intelligence/robotics, mobile ad hoc networking: SWARMANOID, BISON, NCCR-ROBOTICS 1 & 2, SWARMIX.

Individual grants. In the early stages of my career I have been awarded several *individual grants*, including a total of 4 prestigious *Marie Curie / TMR fellowships* (1996-2003), from the scientific institutions of the EU.

References

- [1] E. Feo-Flushing, L. Gambardella, and G. A. Di Caro. *Spatially-distributed missions with heterogeneous multi-robot teams*. *IEEE Access*, vol. 9, pp. 67327–67348, 2021, DOI: 10.1109/ACCESS.2021.3076919.
- [2] M. Schranz, G. A. Di Caro, T. Schmickl, W. Elmenreich, F. Arvin, A. Şekercioğlu, and M. Sende. *Swarm intelligence and cyber-physical systems: Concepts, challenges and future trends*. *Swarm and Evolutionary Computation*, 60, Elsevier, 2021.
- [3] G.A. Di Caro and A.W. Ziaullah Yousaf. *Map learning via adaptive region-based sampling in multi-robot systems*. In **Proc. of the 15th Int. Symposium on Distributed Autonomous Robotic Systems (DARS)**, (Online) Japan, June 1–4, 2021.
- [4] G.A. Di Caro and A.W. Ziaullah Yousaf. *Multi-robot informative path planning using a leader-follower architecture*. In **Proc. of the IEEE Int. Conference on Robotics and Automation (ICRA)**, Xi’an, China, May 30 - June 5, 2021.
- [5] A.W. Ziaullah Yousaf and G.A. Di Caro. *Data sharing and assimilation in multi-robot systems for environment mapping*. In **Proc. of 18th Int. Conf. on Informatics in Control, Automation and Robotics (ICINCO)**, Online, July 6–8, 2021.
- [6] J. Banfi, J. Guzzi, F. Amigoni, E. Feo-Flushing, A. Giusti, L. Gambardella, and G. A. Di Caro. *An integer linear programming model for fair multitarget tracking in cooperative multirobot systems*. *Autonomous Robots*, 34(3):665–680, 2019.
- [7] G. A. Di Caro. *A survey of machine learning for combinatorial optimization*. Invited talk, **30th European Conf. on Operational Research (EURO), Machine Learning and Combinatorial Optimization Track**, Dublin, June 23-26, 2019.
- [8] G. A. Di Caro. *Human-swarm interaction and cooperation*. Invited lecture at the **IEEE RAS Summer School on Multi-Robot Systems**, Prague, Czech Republic, July 29–August 2, 2019.
- [9] G.A. Di Caro and E. Feo-Flushing. *Robot path planning using imprecise and sporadic advisory information from humans*. In **Proc. of 20th Conf. Towards Autonomous Robotic Systems (TAROS)**, pages 235–247, London, July 3–5, 2019.
- [10] B. Gromov, L. Gambardella, and G. A. Di Caro. *Wearable multi-modal interface for human multi-robot interaction*. In **Proc. of 14th IEEE Int. Symposium on Safety, Security, and Rescue Robotics (SSRR)**, pages 240–245, Lausanne, Switzerland, Oct 23–27, 2016.
- [11] J. Nagi, A. Giusti, L. Gambardella, and G. A. Di Caro. *Human-swarm interaction using spatial gestures*. In **Proc. of 27th IEEE/RSJ Int. Conf. on Intelligent Robots and Systems (IROS)**, pages 3834–3841, Chicago, Sep 14–18, 2014.
- [12] J. Guzzi, A. Giusti, L. Gambardella, and G. A. Di Caro. *A model of artificial emotions for behavior-modulation and implicit coordination in multi-robot systems*. In **Proc. of the Genetic and Evolutionary Computation Conference (GECCO)**, pages 21–28, Kyoto, Japan, July 15–19, 2018.
- [13] A. Giusti, J. Guzzi, D. Ciresan, F. Lin, J. P. Rodríguez, F. Fontana, M. Faessler, C. Forster, J. Schmidhuber, G. A. Di Caro, D. Scaramuzza, and L. Gambardella. *A machine learning approach to the visual perception of forest trails for mobile robots*. *IEEE Robotics and Automation Letters*, 1(2):661–667, IEEE RAS, 2016.

2 Education

- **Doctorate, with Full Honors - 11/2004**

INSTITUTION: Faculty of Applied Sciences, Université Libre de Bruxelles (ULB), Brussels, Belgium

DISSERTATION: *Ant Colony Optimization and its application to adaptive routing in telecommunication networks*

SUPERVISOR: Prof. M. Dorigo, FNRS & IRIDIA

- **Diplôme d'Études Approfondies (D.E.A.) (Master of Applied Sciences) - 05/2001**

INSTITUTION: Faculty of Applied Sciences, Université Libre de Bruxelles, Brussels, Belgium

DISSERTATION: *A society of ant-like agents for adaptive routing in networks*

SUPERVISOR: Prof. M. Dorigo, FNRS & IRIDIA

- **Laurea in Physics (B.S. + MSc. equivalent), Summa Cum Laude - 03/1992**

INSTITUTION: Faculty of Mathematical and Physical Sciences, University of Bologna, Bologna, Italy

DISSERTATION: *Implementation of a transputer-based system for real-time parallel data acquisition and the online control of large-scale particle physics detectors (in Italian)*

SUPERVISORS: Prof. R. Campanini and Dr. I. D'Antone, Department of Physics, Bologna

3 Employment: Academic and Research Positions

1. **Associate Teaching Professor [08/2016 - 07/2024]**

INSTITUTION: *Carnegie Mellon University (CMU), CS Department - Qatar Campus*

ACTIVITIES: Teaching in the domains of robotics and AI, research in related domains with a focus on swarm and multi-robot systems and on the application of AI and machine learning to robotics.

2. **Senior Researcher, permanent position [03/2010 - 08/2016]**

INSTITUTION: *"Dalle Molle" Institute for Artificial Intelligence (IDSIA), Lugano (CH)*

ACTIVITIES: Research, teaching, and project writing in the domains of: networking, swarm robotics, swarm intelligence, human-robot interaction, coordination and cooperation in multi-agent systems, ambient assisted living, autonomous robotics, combinatorial optimization, smart grids.

3. **Post-Doctoral Researcher [10/2006 - 03/2010]**

INSTITUTION: *"Dalle Molle" Institute for Artificial Intelligence (IDSIA), Lugano (CH)*

RESEARCH: Design and control of an innovative robotic system made of a swarm of heterogeneous autonomous robots acting and interacting in the full 3D space (EU-funded FET project *Swarmanoid*).

4. **Post-Doctoral Researcher [05/2003 - 09/2006]**

INSTITUTION: *"Dalle Molle" Institute for Artificial Intelligence (IDSIA), Lugano (CH)*

RESEARCH: Study of nature's complex adaptive systems to design robust self-organizing systems for optimization and control in peer-to-peer and mobile ad-hoc networks (EU-funded FET project *BISON*).

5. **Marie Curie Postdoc Fellow [11/2001 - 04/2003]**

INSTITUTION: *IRIDIA, Université Libre de Bruxelles (ULB), Brussels (Belgium)*

RESEARCH: Application of artificial intelligence techniques for control and optimization in telecommunication networks, modeling of complex biological systems.

6. **Research Associate for Japan Science and Technology Corporation (JST) [01/2001 - 09/2001]**

INSTITUTION: *Advanced Telecommunications Research (ATR), Kyoto (Japan)*

RESEARCH: Brain modeling, reinforcement learning in partially observable environments, adaptive setting of meta-parameters for learning algorithms, multi-agent learning.

7. **Science and Technology in Japan Fellow [02/1999 - 11/2000]**
INSTITUTION: *HIP Labs, Advanced Telecommunications Research (ATR), Kyoto (Japan)*
RESEARCH: Distributed multi-agent algorithms for sequential decision making in partially observable environments, modeling and simulation of the human immune system.
8. **TMR - Marie Curie Fellow [08/1996 - 02/1999]**
INSTITUTION: *IRIDIA, Université Libre de Bruxelles (ULB), Brussels (Belgium)*
RESEARCH: Reinforcement learning algorithms for distributed and partially observable environments, applications to adaptive routing and load balancing in telecommunication networks.
9. **Research Associate [03/1996 - 06/1996]**
INSTITUTION: *Department of Biomedical Sciences, University of Modena, Modena (Italy)*
RESEARCH: Modeling of biological and evolutionary systems, management of local computing resources.
10. **Research Consultant [12/1995 - 02/1996]**
INSTITUTION: *Istituto per la Ricerca Scientifica e Tecnologica (IRST), Trento (Italy)*
RESEARCH: Software integration and design of architectures for autonomous robot programming.
11. **Research Associate [01/1995 - 12/1995]**
INSTITUTION: *Department of Mathematics, University of Trento, Trento (Italy)*
RESEARCH: Development of heuristic algorithms for combinatorial optimization, administration of Unix systems and web sites, application of image processing and software engineering techniques.
12. **Post-Graduate Research Fellow [01/1994 - 12/1994]**
INSTITUTION: *IRST, Trento (Italy)*
RESEARCH: Implementation of a real-time stereoscopic vision system for autonomous robotic navigation using a parallel network of digital signal processors.
13. **Post-Graduate Research Fellow [07/1993 - 12/1993]**
INSTITUTION: *IRST, Trento (Italy)*
RESEARCH: Design and realization of a concurrent real-time software architecture for the management of the activities of a mobile autonomous robot equipped with multiple sensors.
14. **Graduate Research Associate [04/1992 - 07/1993]**
INSTITUTION: *Department of Physics, University of Bologna, Bologna (Italy)*
RESEARCH: Parallel implementations of genetic algorithms for optimization, application of fuzzy logic and classical pattern recognition techniques to the discrimination of sub-atomic particle beams.

4 Scientific Publications

4.1 Co-Edited Books

1. G. A. Di Caro and G. Theraulaz, editors. *Bio-Inspired Models of Network, Information, and Computing Systems - Proceedings of the 7th BIONETICS International Conference, 2012*, volume 134 of *LNCS*. Springer, 2014. Lugano, Switzerland, December 10–11, 2012.
2. C. Di Chio, A. Agapitos, S. Cagnoni, C. Cotta, F. Fernández de Vega, G. A. Di Caro, R. Drechsler, A. Ekárt, A. Esparcia-Alcázar, M. Farooq, W.B. Langdon, J.-J. Merelo-Guervós, M. Preuss, H. Richter, S. Silva, A. Simoes, G. Squillero, E. Tarantino, A. Tettamanzi, J. Togelius, N. Urquhart, A. Şima Uyar, and G. Yannakakis, editors. *Applications of Evolutionary Computation - Proceedings of EvoApplications 2012: EvoCOMNET, EvoCOMPLEX, EvoFIN, EvoGAMES, EvoHOT, EvoIASP, EvoNUM, EvoPAR, EvoRISK, EvoSTIM, and EvoSTOC*, volume 7248 of *LNCS*. Springer, 2012. Malaga, Spain, April 11–13, 2012.
3. C. Di Chio, A. Brabazon, G.A. Di Caro, R. Drechsler, M. Farooq, J. Grahl, G. Greenfield, C. Prins, J. Romero, G. Squillero, E. Tarantino, A. Tettamanzi, N. Urquhart, and A.S. Uyar, editors. *Applications of Evolutionary Computation - Proceedings of EvoApplications 2011, Part II: EvoCOMNET, EvoFIN, EvoHOT, EvoMUSART, EvoSTIM, and EvoTRANSLOG*, volume 6625 of *LNCS*. Springer, 2011. Turin, Italy, April 27–29, 2011.
4. M. Dorigo, M. Birattari, G.A. Di Caro, R. Doursat, A. Engelbrecht, D. Floreano, L.M. Gambardella, R. Groß, E. Sahin, H. Sayama, and T. Stützle, editors. *Swarm Intelligence, Proceedings of the 7th International Conference ANTS 2010*, volume 6234 of *LNCS*. Springer, 2010. Brussels, Belgium, September 8–10, 2010.
5. C. Di Chio, A. Brabazon, G.A. Di Caro, M. Ebner, M. Farooq, A. Fink, J. Grahl, G. Greenfield, P. Machado, M. O’Neill, E. Tarantino, and N. Urquhart, editors. *Proceedings of EvoApplications 2010: EvoCOMNET, EvoENVIRONMENT, EvoFIN, EvoMUSART, and EvoTRANSLOG*, volume 6025 of *LNCS*. Springer, 2010. Istanbul, Turkey, April 7–9, 2010.
6. M. Giacobini, A. Brabazon, S. Cagnoni, G.A. Di Caro, R. Drechsler, A. Ekart, A. Esparcia-Alcazar, M. Farooq, A. Fink, J. McCormack, M. O’Neill, J. Romero, F. Rothlauf, G. Squillero, A.S. Uyar, and S. Yang, editors. *Proceedings of EvoWorkshops 2008: EvoCOMNET, EvoENVIRONMENT, EvoFIN, EvoGAMES, EvoHOT, EvoIASP, EvoINTERACTION, EvoMUSART, EvoNUM, EvoPhD, EvoSTOC, and EvoTRANSLOG*, volume 5484 of *LNCS*. Springer, 2009. Tübingen, Germany, April 15–17, 2009.
7. M. Giacobini, A. Brabazon, S. Cagnoni, G.A. Di Caro, R. Drechsler, A. Ekart, A. Esparcia-Alcazar, M. Farooq, A. Fink, J. McCormack, M. O’Neill, J. Romero, F. Rothlauf, G. Squillero, A.S. Uyar, and S. Yang, editors. *Proceedings of EvoWorkshops 2008: EvoCOMNET, EvoFIN, EvoHOT, EvoIASP, EvoMUSART, EvoNUM, EvoSTOC, and EvoTRANSLOG*, volume 4974 of *LNCS*. Springer, 2008. Naples, Italy, March 26–28, 2008.
8. M. Giacobini, A. Brabazon, S. Cagnoni, G. A. Di Caro, R. Drechsler, A. Ekart, , M. Farooq, A. Fink, , E. Lutton, P. Machado, S. Minner, M. O’Neill, J. Romero, F. Rothlauf, G. Squillero, H. Takagi, A.S. Uyar, and S. Yang, editors. *Proceedings of EvoWorkshops 2007: EvoCOMNET, EvoFIN, EvoIASP, EvoINTERACTION, EvoMUSART, EvoSTOC, and EvoTRANSLOG*, volume 4448 of *LNCS*. Springer, 2007.
9. M. Dorigo, G.A. Di Caro, and M. Sampels, editors. *Ant Algorithms - Proceedings of ANTS 2002, Third International Workshop on Ant Algorithms, Brussels, Belgium, September 12–14, 2002*, volume 2463 of *LNCS*. Springer-Verlag, 2002.

4.2 Chapters in Books

1. G.A. Di Caro, F. Ducatelle, and L.M. Gambardella. *Routage dans les réseaux mobiles ad hoc en environnement urbain (in French, "Routing in urban mobile ad hoc networks")*. In N. Monmarché, F. Guinand, and P. Siarry, editors, **Fourmis artificielles 2, nouvelles directions pour une intelligence collective**. Hermès Science Publications, France, 2009.

2. G.A. Di Caro, F. Ducatelle, and L.M. Gambardella. *Routing in urban mobile ad hoc networks (translated and reprinted from Hermès Science Publications)*. In N. Monmarché, F. Guinand, and P. Siarry, editors, **Artificial ants**, page 576. Wiley-ISTE, 2010.
3. M. Farooq and G.A. Di Caro. *Routing protocols for next generation networks inspired by collective behaviors of insect societies: An overview*. In C. Blum and D. Merckle, editors, **Swarm Intelligence: Introduction and Applications**, Natural Computing. Springer, 2008.
4. G.A. Di Caro, F. Ducatelle, and L.M. Gambardella. *Theory and practice of Ant Colony Optimization for routing in dynamic telecommunications networks*. In N. Sala and F. Orsucci, editors, **Reflecting interfaces: the complex coevolution of information technology ecosystems**, pages 185–216. Idea Group, Hershey, USA, 2008.
5. M. Dorigo and G.A. Di Caro. *The ant colony optimization meta-heuristic*. In D. Corne, M. Dorigo, and F. Glover, editors, **New Ideas in Optimization**, pages 11–32. McGraw-Hill, 1999.

4.3 Refereed Journal Papers

1. E. Feo-Flushing, L. Gambardella, and G. A. Di Caro. *Spatially-distributed missions with heterogeneous multi-robot teams*. **IEEE Access**, 2021. DOI: 10.1109/ACCESS.2021.3076919.
2. M. Schranz, G. A. Di Caro, T. Schmickl, W. Elmenreich, F. Arvin, A. Şekercioglu, and M. Sende. *Swarm intelligence and cyber-physical systems: Concepts, challenges and future trends*. **Swarm and Evolutionary Computation**, 60, Elsevier, 2021.
3. J. Banfi, J. Guzzi, , F. Amigoni, E. Feo-Flushing, A. Giusti, L. Gambardella, and G. A. Di Caro. *An integer linear programming model for fair multitarget tracking in cooperative multirobot systems*. **Autonomous Robots**, 34(3):665–680, 2019.
4. R. Magán-Carrión, J. Camacho, P. Garcia-Teodoro, E. Feo-Flushing, and G. A. Di Caro. *A dynamical relay node placement solution for MANETs*. **Computer Communications**, 114:36–50, Elsevier, December 2017.
5. A. Giusti, J. Guzzi, D. Ciresan, F. Lin, J. P. Rodríguez, F. Fontana, M. Faessler, C. Forster, J. Schmidhuber, G. A. Di Caro, D. Scaramuzza, and L. Gambardella. *A machine learning approach to the visual perception of forest trails for mobile robots*. **IEEE Robotics and Automation Letters**, 1(2):661–667, IEEE RAS, 2016.
6. G. A. Di Caro. *Principi di swarm intelligence per problemi di routing adattivo in reti di telecomunicazione*. **Sistemi Intelligenti**, 26(3):443–464, Il Mulino, December 2014. [In Italian].
7. A. Reina, L. M. Gambardella, M. Dorigo, and G. A. Di Caro. *zePPELIN: Distributed path planning using an overhead camera network*. **International Journal of Advanced Robotic Systems**, 11(119):1–22, InTech, 2014.
8. F. Ducatelle, G. A. Di Caro, A. Förster, M. Bonani, M. Dorigo, S. Magnenat, F. Mondada, R. O’Grady, C. Pinciroli, P. Rétonnaz, V. Trianni, and L. M. Gambardella. *Cooperative navigation in robotic swarms*. **Swarm Intelligence**, 8(1):1–33, Springer, 2014.
9. A. Giusti, M. Salani, G. A. Di Caro, A. E. Rizzoli, and L. M. Gambardella. *Restricted neighborhood communication improves decentralized demand-side load management*. **IEEE Transactions on Smart Grid**, 5(1):92–101, IEEE, January 2014.
10. M. Dorigo, D. Floreano, L. M. Gambardella, F. Mondada, S. Nolfi, T. Baaboura, M. Birattari, M. Bonani, M. Brambilla, A. Brutschy, D. Burnier, A. Campo, A. L. Christensen, A. Decugnière, G. A. Di Caro, F. Ducatelle, E. Ferrante, A. Förster, J. Guzzi, V. Longchamp, S. Magnenat, J. Martinez Gonzales, N. Mathews, M. Montes de Oca, R. O’Grady, C. Pinciroli, G. Pini, P. Rétonnaz, J. Roberts, V. Sperati, T. Stirling, A. Stranieri, T. Stützle, V. Trianni, E. Tuci, A. E. Turgut, and F. Vaussard. *Swarmanoid: A novel concept for the study of heterogeneous robotic swarms*. **IEEE Robotics & Automation Magazine**, 20(4):60–71, IEEE RAS, 2013.

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12. R. Montemanni, M. Mojana, G. A. Di Caro, and L. M. Gambardella. *A decomposition-based exact approach for the sequential ordering problem*. **Journal of Applied Operational Research (JAOR)**, 5(1):2–13, ORLab, 2013.
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4.4 Conference/Workshop Papers

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2. G.A. Di Caro and A.W. Ziaullah Yousaf. *Multi-robot informative path planning using a leader-follower architecture*. In **Proceedings of the IEEE International Conference on Robotics and Automation (ICRA)**, Xi'an, China, May 30 - June 5, 2021.
3. G.A. Di Caro and A.W. Ziaullah Yousaf. *Map learning via adaptive region-based sampling in multi-robot systems*. In **Proceedings of the 15th International Symposium on Distributed Autonomous Robotic Systems (DARS)**, (Online) Kyoto, Japan, June 1–4, 2021.
4. G.A. Di Caro and E. Feo-Flushing. *Robot path planning using imprecise and sporadic advisory information from humans*. In **Proceedings of the 20th Conference Towards Autonomous Robotic Systems (TAROS)**, volume 11650 of **Springer LNAI**, pages 235–247, London, UK, July 3–5, 2019.
5. G. A. Di Caro. *A survey of machine learning for combinatorial optimization*. In **30th European Conference on Operational Research (EURO), Machine Learning and Combinatorial Optimization Track**, Dublin, Ireland, June 23–26, 2019 (no proceedings).
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81. G.A. Di Caro, F. Ducatelle, and L. M. Gambardella. *AI approaches for next generation telecommunication networks*. In **Poster at the 50th Anniversary Summit of Artificial Intelligence**, Monte Verità, Switzerland, July 9–14, 2006.
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85. G.A. Di Caro, F. Ducatelle, and L.M. Gambardella. *Swarm intelligence for routing in mobile ad hoc networks*. In **Proceedings of the IEEE Swarm Intelligence Symposium (SIS)**, pages 76–83, Pasadena, USA, June 8–10, 2005.
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89. G.A. Di Caro and T. Vasilakos. *Ant-SELA: Ant-agents and stochastic automata learn adaptive routing tables for QoS routing in ATM networks*. In **Internal conference proceedings of ANTS'2000 - From Ant Colonies to Artificial Ants: Second International Workshop on Ant Colony Optimization (No published proceedings)**, Brussels, Belgium, September 8–9, 2000.
90. S. Valensin and G.A. Di Caro. *A theoretical model for in machina experiments on immunosenescence*. In **Proceedings of the EMBO Workshop on Molecular and Cellular Gerontology**, Serpiano, Switzerland, 1999. Published on the *Annals of the New York Academy of Sciences*, Vol. 908:344–347 (2000).
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93. M. Dorigo and G.A. Di Caro. *Ant colony optimization: A new meta-heuristic*. In **Proceedings of CEC99 - Congress on Evolutionary Computation**, Washington DC, July 6-9 1999.
94. G.A. Di Caro and M. Dorigo. *Extending AntNet for best-effort Quality-of-Service routing*. In **Internal conference proceedings of ANTS'98 - From Ant Colonies to Artificial Ants: First International Workshop on Ant Colony Optimization (No published proceedings)**, Brussels, Belgium, October 15–16, 1998.
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96. G.A. Di Caro and M. Dorigo. *An adaptive multi-agent routing algorithm inspired by ants behavior*. In **Proceedings of PART98 - 5th Annual Australasian Conference on Parallel and Real-Time Systems**, pages 261–272. Springer-Verlag, 1998.

97. G.A. Di Caro and M. Dorigo. *Ant colonies for adaptive routing in packet-switched communication networks*. In A. E. Eiben, T. Back, M. Schoenauer, and H.-P. Schwefel, editors, **Proceedings of PPSN-V, 5th International Conf. on Parallel Problem Solving from Nature**, volume 1498 of LNCS, pages 673–682. Springer-Verlag, 1998.
98. G.A. Di Caro and M. Dorigo. *Ant colony routing*. In **PECTEL 2 Workshop on Parallel Evolutionary Computation in Telecommunications (No published proceedings)**, Reading, England, April 6–7, 1998.
99. G.A. Di Caro and M. Dorigo. *Mobile agents for adaptive routing*. In **Proceedings of the 31st International Conference on System Sciences (HICSS-31)**, volume 7, pages 74–83. IEEE Computer Society Press, 1998.
100. G.A. Di Caro and M. Dorigo. *Adaptive learning of routing tables in communication networks*. In **Proceedings of the Italian Workshop on Machine Learning**, Torino, Italy, December 9-10 1997.
101. G.A. Di Caro and M. Dorigo. *AntNet: A mobile agents approach to adaptive routing in communication networks*. In **Abstract at the Ninth Dutch Conference on Artificial Intelligence (NAIC '97)**, Antwerpen, Belgium, November 12–13, 1997.
102. G.A. Di Caro and M. Dorigo. *Distributed reinforcement agents for adaptive routing in communication networks*. In **Abstract proceedings of the Third European Workshop on Reinforcement Learning (EWRL-3) (No published proceedings)**, Rennes, France, October 13–14, 1997.
103. F. Valentinotti, G.A. Di Caro, and B. Crespi. *A parallel dsp system for real-time disparity and optical flow using phase difference*. In **Proceedings of 6th International Conference on Signal Processing Applications and Technology (ICSPAT-95)**, Boston, USA, October 24-26, 1995.
104. R. Cattoni, G.A. Di Caro, M. Aste, and B. Caprile. *Bridging the gap between planning and reactivity: a layered architecture for autonomous indoor navigation*. In **Proceedings of the 7th IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)**, pages 878–885, 1994.
105. R. Campanini, I. D'Antone, G.A. Di Caro, and G. Giusti. *Implementation strategies for a parallel expert diagnostic system*. In **Proceedings of the Conf. 2nd International Workshop on Software Engineering, Artificial Intelligence and Expert Systems for High Energy Physics**, L'Agelonde, France, January 13-18 1992.
106. R. Campanini, I. D'Antone, G.A. Di Caro, and G. Giusti. *Development of a real-time diagnostic system for data acquisition*. In **Atti del 6° Convegno sulla Programmazione Logica (GULP '91)**, Pisa, Italy, June 12-14 1991.
107. R. Campanini, I. D'Antone, G.A. Di Caro, and G. Giusti. *A transputer-based real-time acquisition and control system*. In **Poster at Transputing '91, First World Transputer User Group Conference**, Sunnyvale, California, April 1991.

4.5 Refereed Video Productions

1. SWARMIX project team (www.swarmix.org). *Finding Linda - A Search and Rescue Mission by SWARMIX*. In **Proceedings of the 10th AAI Video Competition**, Phoenix, AR, USA, February 12–17, 2016. (Most Entertaining Video award, and Nominated for Best Video and Best Robot Video awards).
2. A. Giusti, J. Guzzi, D. Ciresan, F.-L. He, J. P. Rodriguez, G. A. Di Caro, J. Schmidhuber, L. M. Gambardella, F. Fontana, M. Faessler, C. Forster, and D. Scaramuzza. *Quadcopter navigation in the forest*. In **Proceedings of the 10th AAI Video Competition**, Phoenix, AR, USA, February 12–17, 2016. (Nominated for Best Robot Video award).
3. SWARMANOID project team (www.swarmanoid.org). *Swarmanoid, the movie*. In **Proceedings of the 5th AAI Video Competition**, San Francisco, CA, USA, August 7–11, 2011. (Best video award).

4.6 Unpublished Technical Reports

1. G.A. Di Caro and E. Feo. *An analytical model for IEEE 802.15.4 non-beacon enabled CSMA/CA in multihop wireless sensor networks*. Technical Report 05-11, IDSIA, Lugano (Switzerland), May 2011.
2. G.A. Di Caro, F. Ducatelle, and L.M. Gambardella. *Ant Colony Optimization for Routing in Mobile Ad Hoc Networks in Urban Environments*. Technical Report 05-08, IDSIA, Lugano (Switzerland), May 2008.
3. F. Ducatelle, G.A. Di Caro, and L.M. Gambardella. *A study on the use of MANETs in an urban environment*. Technical Report 01-07, IDSIA, Lugano (Switzerland), January 2007.
4. G.A. Di Caro, F. Ducatelle, and L.M. Gambardella. *Studies of routing performance in a city-like testbed for mobile ad hoc networks*. Technical Report 07-06, IDSIA, Lugano (Switzerland), March 2006.
5. G.A. Di Caro. *Analysis of simulation environments for mobile ad hoc networks*. Technical Report 24-03, IDSIA, Lugano, (Switzerland), December 2003.
6. G.A. Di Caro. *A society of ant-like agents for adaptive routing in networks*. Technical Report 02-33, IRIDIA, Université Libre de Bruxelles, Brussels, Belgium, October 2002.
7. M. Birattari, G.A. Di Caro, and M. Dorigo. *For a Formal Foundation of the Ant Programming Approach to Combinatorial Optimization. Part 1: The problem, the representation, and the general solution strategy*. Technical Report TR-H-301, Advanced Telecommunications Research Institute (ATR), Human Information Processing Laboratories, Kyoto, Japan, December 2000.
8. G.A. Di Caro and M. Dorigo. *A Study of Distributed Stigmergetic Control for Packet-switched Communications Networks*. Technical Report 97-18, IRIDIA, Université Libre de Bruxelles, Brussels, Belgium, November 1997.
9. G.A. Di Caro and M. Dorigo. *AntNet: A mobile agents approach to adaptive routing*. Technical Report 97-12, IRIDIA, Université Libre de Bruxelles, Brussels, Belgium, June 1997.
10. G.A. Di Caro. *ARCA: a Software Architecture to Program Robots*. Internal Report IRST, Istituto per la Ricerca Scientifica e Tecnologica, Trento, Italy, January 1996.
11. G.A. Di Caro. *Style and Organization Rules for the Development of C Programs*. Technical Report UTM-462, Department of Mathematics, University of Trento, Trento, Italy, May 1995.

5 Contract and Grant Support

5.1 Current Collaborative Grants

1. **Project:** *Communications-aware distributed deep reinforcement learning in multi-robot teams for underwater inspection tasks.*

Grant No: UREP27-146-2-043

Role: *Primary Research Mentor.*

Funding agency: Qatar National Research Foundation (QNRF).

Amount: 10,000 USD.

Duration: 1 year, from January 2021.

Affiliation: CMU-Q.

Description: The project addresses the use of autonomous mobile multi-robot systems for underwater inspection tasks (e.g., inspection of oil and gas offshore platforms). Underwater scenarios present major challenges and limitations for communications, localization, and perception. To tackle these challenges, project aims to develop a solution based on distributed deep reinforcement learning. The goal is to design a learning architecture that can effectively let the robots jointly learn an action policy balancing the needs for mission accomplishment and for supporting communications in the robots' mobile ad hoc network. Algorithm training and validation will be done in simulation. A realistic simulator will be developed integrating ROS and NS-3 environments.

2. **Project:** *Teams of Aquatic / Aerial Robots for Marine Environmental Monitoring (TARMEM).*

Grant No: NPRP10-0213-170458

Role: *Lead PI.*

Funding agency: National Priority Research Program - Qatar National Research Foundation (QNRF).

Amount: 600,000 USD.

Duration: 3 years, from August 2018.

Affiliation: CMU-Q.

Partners: ISME (Integrated Systems for Marine Environment), Genova, Italy.

Description: The project integrates multiple aerial and water surface autonomous robots (UAVs, USVs) for cooperative missions in marine environments. In a given time budget, robots are used to acquire data to build accurate data maps of interest (e.g., water quality, depths, salinity). Research focus is on: distributed planning and coordination exploiting complementary sensory-motor skills; distributed learning of Gaussian processes; integration of network control with mission-based decision-making; resilience to failures and hostile conditions; use of surface robots as carriers of aerial robots to support long-running missions; dynamic schedule of meeting points and takeoff and landing between UAVs and USVs.

5.2 Past Collaborative Grant Support

1. **Projects:** *(i) Symbiotic interaction between humans and multi-robot systems, (ii) Coalition-level team planning, (iii) Resilient path planning for ground robots.*

Role: *Projects' Co-PI* with Luca Gambardella (IDSIA).

Funding agency: Swiss National Science Foundation (SNSF) through the National Centre of Competence in Research (NCCR) Robotics, Phase 2.

Amount: 600,000 CHF.

Duration: 4 years, from 12/2014.

Affiliation: Dalle Molle Institute for Artificial Intelligence (IDSIA).

Description: The three projects are integral part of the nation-wide NCCR Robotics, Center of Excellence of Swiss NSF. In its Phase 2, the Center includes 18 research groups and is supported by a grant of

more than 12M CHF (www.nccr-robotics.ch). IDSIA sub-projects address: multi-modal interaction and communication between humans and multiple robots; system-level planning in the space of the feasible coalitions that can be built in mixed human-robot teams; path planning models that are resilient to multiple local failures.

2. **Project:** *ALMA: Ageing without Losing Mobility and Autonomy* [4/2013, 3.5 years].

Role: *Project Coordinator and Principal Investigator (PI)*.

Funding agency: Ambient Assisted Living (AAL) - Scientific Institutions of the European Community.

Amount: 1M CHF

Duration: 3.5 years, from 4/2013.

Affiliation: Dalle Molle Institute for Artificial Intelligence (IDSIA).

Description: A total grant of 3M EUR. The consortium has included 8 partners (academic, industrial, and care-giving ones). The project (www.alma-aal.org) has resulted in a set of ambient intelligence and robotic technologies and their integration into a modular system aimed to support autonomous mobility, navigation, and orientation of the mobility-impaired person through the realization. Validation and testing of the developed technologies have been performed at real end-user institutions.

3. **Project:** *Let's play together with robot swarms!*

Role: *Project Co-PI* with Luca Gambardella (IDSIA) and Francesco Mondada (EPFL).

Funding agency: Swiss National Science Foundation (SNF) through the National Centre of Competence in Research (NCCR) Robotics, Phase 1.

Amount: 100k CHF.

Duration: 1 year, from 7/2013.

Affiliation: Dalle Molle Institute for Artificial Intelligence (IDSIA).

Description: Design and implementation of game scenarios, both in simulation and using real robots, to study strategies and modalities to let humans and multi-robot systems effectively team up. A game with multiple pursuers and evaders, including both humans and robots, was setup and demonstrated.

4. **Project:** *SWARMIX: Synergistic Interactions in Swarms of Heterogeneous Agents*.

Role: *Co-PI* with Luca Gambardella for IDSIA's research activities in the project.

Funding agency: Swiss National Science Foundation (SNF), SINERGIA Program.

Amount: 250k CHF.

Duration: 3.5 years, from 2/2011.

Affiliation: Dalle Molle Institute for Artificial Intelligence (IDSIA).

Description: 1.1M CHF total grant funded by Swiss NSF, 4 research groups. IDSIA's research for the project addressed the study of adaptive planning and communication strategies for heterogeneous swarms, considering search and rescue scenarios and swarms composed of robots, humans, and dogs.

5. **Project:** *Symbiotic human-swarm interaction and cooperation*.

Role: *Co-PI* with Luca Gambardella for IDSIA's research activities in the project.

Funding agency: Swiss National Science Foundation (SNF) through the National Centre of Competence in Research (NCCR) Robotics, Phase 1.

Amount: 200k CHF.

Duration: 4 years, from 12/2010.

Affiliation: Dalle Molle Institute for Artificial Intelligence (IDSIA).

Description: The sub-project was integral part of the large nation-wide NCCR Robotics, Center of Excellence of Swiss NSF, including 26 research groups in its Phase 1 and supported by a total grant of 13.3M CHF (www.nccr-robotics.ch). IDSIA's sub-project resulted in robust and scalable methods for the interaction, control, and coordination of heterogeneous symbiotic teams of multiple robots and humans.

6. **Project:** *SWARMANOID: Towards Humanoid Robotic Swarms.*

Role: *Co-PI* with Luca Gambardella for IDSIA's research activities in the project.

Funding agency: FP6 FET Open programme - Scientific Institutions of the European Community.

Amount: 600k CHF.

Duration: 4 years, from 1/2006.

Affiliation: Dalle Molle Institute for Artificial Intelligence (IDSIA).

Description: 3.9M EUR total grant in the FP6 FET Open programme. Consortium of 5 partners. The project focused on the design, implementation, and distributed control of a novel swarm robotic system comprising heterogeneous, dynamically connected small autonomous robots in 3D: eye-bots (flying), hand-bots (grasping), and foot-bots (ground).

7. **Project:** *BISON: Biology-Inspired techniques for Self-Organization in dynamic Networks.*

Role: *Co-PI* with Luca Gambardella for IDSIA's research activities in the project (Note: I did not contribute to project writing).

Funding agency: FP5 FET Open programme - Scientific Institutions of the European Community.

Duration: 3 years, from 5/2003.

Amount: 400k CHF.

Affiliation: Dalle Molle Institute for Artificial Intelligence (IDSIA).

Description: 1.7M EUR total grant funded in the FP5 FET Open programme. Consortium of 5 partners. The project focused on developing bio-inspired approaches for adaptive routing and control in dynamic networks, such as mobile ad hoc and P2P networks.

5.3 Past Individual Project Grants and Fellowships Support

1. **Marie Curie post-doc fellowship for project *Ant and learning agents for adaptive routing and distributed control in communication networks*.**

Individual research grant of about 100k EUR awarded by the Marie Curie program of the scientific institutions of the European Community.

Host institution: IRIDIA, Université Libre de Bruxelles, Belgium.

Duration: 2.5 years, from 11/2001.

2. **Science & Technology in Japan post-doc fellowship for project *Mobile stigmergetic agents for control of network systems*.**

Individual research grant of about 130k EUR awarded by the scientific institutions of the European Union.

Host institution: Advanced Telecommunications Research International (ATR), Kyoto, Japan.

Duration: 2 years, from 2/1999.

3. **Training and Mobility of Researchers (TMR) post-doc fellowship for project *Multi-agent based techniques for distributed adaptive routing*.**

Individual research grant of about 100k EUR awarded by the Marie Curie program of the scientific institutions of the European Community.

Host institution: Université Libre de Bruxelles, Belgium (Note: the grant was not exploited since at the same time I obtained the S&T Fellowship for Japan, which I opted for).

Duration: 2.5 years, from 2/1999.

4. **Training and Mobility of Researchers (TMR) post-grad fellowship for project *Autonomous reinforcement learning agents for Partially Observable Markov Decision environments*.**

Individual research grant of about 100k EUR awarded by the Marie Curie program of the scientific institutions of the European Union.

Host institution: IRIDIA, Université Libre de Bruxelles, Belgium.

Duration: 2.5 years, from 8/1996.

5. **Post-grad fellowship for studies on *Artificial Intelligence and Robotics*.**

Individual research grant of about 21k EUR awarded by the municipality of Trento (Italy).

Host institution: Istituto per la Ricerca Scientifica e Tecnologica (IRST), Trento, Italy.

Duration: 1 year, from 1/1994.

6. **Post-grad fellowship for studies on *Pattern Recognition*.**

Individual research grant 11k EUR awarded by the municipality of Trento (Italy).

Host institution: Istituto per la Ricerca Scientifica e Tecnologica (IRST), Trento, Italy.

Duration: 0.5 years, from 7/1993.

6 Professional Activities

6.1 Conferences and Workshops Committees: Chair

1. G. A. Di Caro, M. Salani, *Machine Learning and Combinatorial Optimization*, Session in the Combinatorial Optimization stream at the *31st European Conf. on Operational Research (EURO)*, Athens, Greece, July 11-14, 2021.
2. G. A. Di Caro, *BIONETICS: 7th International Conference on Bio-Inspired Models of Network, Information, and Computing Systems* Lugano, Switzerland, December 10–11, 2012.
3. E. Natalizio, T. Razafindralambo, G. A. Di Caro, *MC³ 2012: 1st International Workshop on Mobility and Communication for Cooperation and Coordination*, in conjunction with the “Int. Conference on Computing, Networking and Communications (ICNC 2012)”, Maui, Hawaii, USA, Jan 30 – Feb 2, 2012.
4. G. A. Di Caro, M. Farooq and E. Tarantino, *EvoCOMNET: 9th European Event on the Application of Nature-inspired Techniques to Telecommunication Networks and other Parallel and Distributed Systems*, Malaga, Spain, April 11–13, 2012.
5. G. A. Di Caro, M. Farooq and E. Tarantino, *EvoCOMNET: 8th European Event on the Application of Nature-inspired Techniques to Telecommunication Networks and other Parallel and Distributed Systems*, Turin, Italy, April 27–29, 2011.
6. M. Dorigo, G.A. Di Caro, A. Engelbrecht, L. Gambardella and E. Sahin, *ANTS 2010, 7th International Conference on Swarm Intelligence*, Brussels, Belgium, September 8–10, 2010.
7. G. A. Di Caro, M. Farooq and E. Tarantino, *EvoCOMNET: 7th European Event on the Application of Nature-inspired Techniques to Telecommunication Networks and other Parallel and Distributed Systems*, Istanbul, Turkey, April 7–9, 2010.
8. G. A. Di Caro, M. Farooq and E. Tarantino, *EvoCOMNET: 6th European Workshop on the Application of Nature-inspired Techniques to Telecommunication Networks and other Parallel and Distributed Systems*, Tübingen, Germany, April 15-17, 2009.
9. G. A. Di Caro, F. Ducatelle, A. Forster, G. Venayagamoorthy, *5th IEEE Symposium on Swarm Intelligence, Special Session on: Swarm Intelligence for Wireless Ad Hoc Networks*, St. Louis, Missouri, USA, September 21–23, 2008.
10. G. A. Di Caro and M. Farooq, *EvoCOMNET: 5th European Workshop on the Application of Nature-inspired Techniques to Telecommunication Networks and other Connected Systems*, Naples, Italy, March 26–28, 2008.
11. G. A. Di Caro and M. Farooq, *EvoCOMNET: 4th European Workshop on the Application of Nature-inspired Techniques to Telecommunication Networks and other Connected Systems*, Valencia, Spain, April 11-13, 2007.
12. M. Dorigo, G.A. Di Caro, N. Sampels, *ANTS’02, 3rd International Workshop on Ant Algorithms*, Brussels, Belgium, September 12–14, 2002.

6.2 Editor of Journal Special Issues

1. G. A. Di Caro, V. Maniezzo, R. Montemanni, M. Salani, Eds., “Special issue on Machine Learning and Combinatorial Optimization”, *OR Spectrum*, Springer, To appear, 2021
2. E. Natalizio, G. Di Caro, A. Sekercioglu, E. Yanmaz, Eds., “Special issue on Theory, Algorithms and Applications of Wireless Networked Robotics”, *Ad Hoc Networks*, Elsevier, Vol. 11, N. 7, 2013.

3. M. Dorigo, M. Birattari, G.A. Di Caro, R.Doursat, A. Engelbrecht, L.M. Gambardella, R. Groß, E. Sahin, T. Stützle, Eds., “Special issue of ANTS 2010”, *Swarm Intelligence*, Springer, Vol. 5, N. 3–4, 2011.
4. M. Dorigo, G. A. Di Caro, T. Stützle, Guest Eds. “Special Issue on Ant Algorithms”, *Future Generation Computer Systems (FGCS)*, Elsevier, Vol. 16, N. 8, 2000.

6.3 Conference and Workshop Committees: Associate Editor, PC Member, or Reviewer

(Incomplete list) PPSN V-VII, IEEE SIS 2005–2008, IEEE ICC 2007, DSN 2007, Bio-ADIT, GP 1998, AAMAS 2004, GECCO 2005-2015, ANTS 1998–2014, BIONETICS 2011-2012, IROS 2011-2014, IEEE IoT-SoS 2012, PPSN 2012, ICRA 2013-14, MobiCASE 2013, ALIFE 2014, PPSN 2014, DroNet 2015, TPNC 2015, ICRA 2016 2017 (Associate editor), ANTS 2016, ANT S2018, SSRR 2018, DARS 2018,2020, 2021, ICARSC 2015,2020, 2021, ANTS 2020.

6.4 Memberships in Professional Societies

- IEEE Robotics and Automation Society

6.5 Editorial Board Memberships

- *Swarm Intelligence*, Springer

6.6 Journal Reviewer

(Incomplete list) IEEE Trans. on Systems, Man, and Cyb., Networks, Adaptive Behavior, IEEE Trans. on Evolutionary Comp., J. of Heuristics, Artificial Life, Swarm Intelligence J., Telecomm. Systems, European J. of Operational Research, J. of Networks, ACM Trans. on Internet Technology, J. of Systems Science, J. of System Architectures, J. of Computer Science, Computer Networks, ACM Trans. on Autonomous Adaptive Systems, Electronic and Telecomm. Research Institute J., Ad Hoc Networks, J. of Computational Intelligence and Applications, Sensors, European J. of Operations Research., IEEE Trans. on Robotics, Artificial Intelligence, Robotics and Autonomous Systems, Computational Intelligence, International Journal of Disaster Risk Reduction, Journal of Artificial Intelligence Research, OR Spectrum.

6.7 External Expert for Research Projects

- Expert in swarm robotics in the External Stakeholders Group (ESG) for the EU-H2020 project *CPSwarm* (9 partners, 4.9M EUR funding, <https://www.cpswarm.eu/>)

7 Scientific Awards, Invited Talks and Colloquia

7.1 Scientific Awards

- **Most entertaining video award, and nomination for for best video and best robot video awards at the 10th AAAI Video Competition**, Phoenix, February 12–17, 2016. Awarded to the video: *Finding Linda - A Search and Rescue Mission by SWARMIX*, SWARMIX project team.
- **Nomination for best video award at the 10th AAAI Video Competition**, Phoenix, February 12–17, 2016. Awarded to the video: *Quadcopter Navigation in The Forest*, A. Giusti, J. Guzzi, D. Cirestan, F.-L. He, J. P. Rodriguez, G. A. Di Caro, J. Schmidhuber, L. M. Gambardella, F. Fontana, M. Faessler, C. Forster, D. Scaramuzza.
- **Nomination for best conference paper at the 11th IEEE Int. Symposium on Safety, Security, and Rescue Robotics (SSRR)**, Linköping, Sweden, Oct. 21–26, 2013. Awarded to paper: *Connectivity-aware planning of search and rescue missions*, E. Feo, M. Kudelski, L. Gambardella, G. A. Di Caro.
- **Best paper at the 7th Int. Conf. on Bio-Inspired Models of Network, Information, and Computing Systems (BIONETICS)**, Lugano, CH, Dec. 10–11, 2012. Awarded to paper: *Bioinspired obstacle avoidance algorithms for robot swarms*, J. Guzzi, A. Giusti, L. Gambardella, G. A. Di Caro.
- **Best research paper at the 2nd Annual International Conference on Advanced Topics in Artificial Intelligence (ATAI)**, Singapore, November 24–25, 2011. Awarded to paper: *An algorithm combining linear programming and an ant system for the sequential ordering problem*, M. Mojana, R. Montemanni, G.A. Di Caro and L.M. Gambardella.
- **Best video award at the 5th AAAI Video Competition**, San Francisco, August 7–11, 2011. Awarded to the video: *Swarmanoid, The Movie*, Swarmanoid project team.
- **Best conference poster at the 12th Conference Towards Autonomous Robotic Systems (TAROS)**, Sheffield, UK, August 31 – September 2, 2011. Awarded to paper: *Distributed motion planning for ground objects using a network of robotic ceiling cameras*, A. Reina, G.A. Di Caro, F. Ducatelle, L.M. Gambardella.
- **Best conference paper at the 8th International Conf. on Parallel Problem Solving from Nature (PPSN VIII)**, Birmingham, UK, 18–22 September 2004. Awarded to paper: *AntHocNet: an Ant-Based Hybrid Routing Algorithm for Mobile Ad Hoc Networks*, G. Di Caro, F. Ducatelle and L.M. Gambardella.

7.2 Invited Talks

- **INVITED TALK: Teams of Aquatic and Aerial Robots for Marine Environmental Monitoring at Research Outcome Seminar on Artificial Intelligence, Qatar National Research Fund (QNRF)**, Doha, Qatar, November 5, 2020.
- **INVITED KEYNOTE TALK: Robot Swarms and the Human-in-the-Loop at ROBOT 2019, 4th Iberian Robotics Conference**, Porto, Portugal, November 20–22, 2019.
- **INVITED SEMINAR: Coordination, Control, and Interaction in Robot Swarms and Multi-Robot Systems at UBS Business Solutions AG**, Zurich, Switzerland, October 18, 2019.
- **INVITED RESEARCH TALK: A survey of Machine Learning for Combinatorial Optimization, at EURO 2019, the 30th European Conference on Operational Research, Machine Learning and Combinatorial Optimization Track**, Dublin, Ireland, 23-26 June, 2019.

- INVITED LECTURE SERIES: *Human-swarm interaction and cooperation* at the **IEEE RAS Summer School on Multi-Robot Systems**, Prague, Czech Republic, July 29–August 2, 2019.
- INVITED KEYNOTE TALK: *Robot Swarms: The human-in-the-loop*, at **Lakeside Labs Research Days 2017 on Self-organization and Swarm Intelligence in Cyber-Physical systems**, Klagenfurt, Austria July 10–12, 2017.
- INVITED TALK: *Interaction, communication, and control in mixed teams of robot swarms and human agents*, at the techno-managerial festival **Pragyan '16, National Institute of Technology Tiruchirappalli (NIT-T), India**, February 27, 2016.
- INVITED TALK: *Swarm intelligence in the physical world*, at the techno-managerial festival **Technex'16, Indian Institute of Technology (BHU) Varanasi, India**, March 4, 2016.
- INVITED TALK: *Adaptive mission planning in mixed swarms*, **Navigare Workshop: Cooperative and Swarm Navigation**, Thun, Switzerland, organized by Swiss Institute of Navigation & Armasuisse, May, 2015.
- INVITED TALKS: *Swarm intelligence and mixed (robot) teams: Interaction, communication, and control*, at the **Indian Institutes of Technology (IIT) of Delhi, Kharagpur, and Roorkee**, tour organized by Swissnex India and Swiss Embassy in India, January 30 – February 6, 2015.
- INVITED KEYNOTE TALK: *Collaborative mission planning and adaptive control in heterogeneous networked teams*, **2nd AETOS International Conference on “Research challenges for future RPAS/UAV systems”**, Bordeaux, France, September 9–10, 2014.
- INVITED TALK: *Human-swarm interaction, Towards a Swiss Robotics Rescue Team*, **Workshop at the IEEE International Conference on Robotics and Automation (ICRA)**, Karlsruhe, Germany, May 6–10, 2013.
- INVITED TALK: *Power of the Swarm, in Natural, Simulation, and Robotic Worlds*, at the **International exhibition “Think Art–Act Science”**, **San Francisco Art Institute**, September 23, 2011.
- Participation to the research presented in **Swarmanoid, The Movie**, winner of the AAI-2011 Best Video Award, September 8th, 2011.

7.3 Seminars and Colloquia

- Special guest at the **TV science show “Stem”** of RAI, the national public broadcasting company of Italy, to talk about swarm intelligence and swarm robotics (the interview will be broadcast in Sep 2021).
- Interview featured by the **Gulf Times** newspaper on the topic *AI and robots to explore Qatar’s waters*, published on March 25th, 2021.
https://www.gulf-times.com/story/687433/Carnegie-Mellon-uses-AI-and-robots-to-explore-Qata?fbclid=IwAR01NgMQUNVI9rAwVc_jjq9y4mQDv6i98SLDabK8Ygw0ISPsiEpA1GH36i0
- Interview featured by **TechTalk** Blog on the topic *Mission objective: Exploring seas with teams of autonomous robots*, published on the web on February 13th, 2020.
<https://talkk.tech.blog/2020/02/13/mission-objective-exploring-seas-with-teams-of-autonomous-robots/>
- Special guest at the **TV science show “Il Giardino di Albert”**, on RSI 1, the official Italian-speaking broadcast TV of Switzerland, to talk about robotics, February 20th, 2012.
- Interviewed by **The Economist** magazine, for the article *Riders on a swarm*, about swarm intelligence technologies, published on August 12th, 2010.
- Interviewed by the **Reflex magazine** (an EPFL-sponsored publication), for the 82-pages special issue on “Les secrets de l’intelligence”, published on May 2010.

8 Teaching

8.1 Courses Taught at Carnegie Mellon

1. 15-288 Machine Learning in a Nutshell

- Spring'21 in Doha, 9 units
- Class of 20 students
- Average of course evaluations: 4.43

2. 15-110 Principles of Computing

- Spring'21 in Doha, 10 units
- Class of 21 students
- Average of overall teaching evaluation: 3.85

3. 15-281 Artificial Intelligence: Representation and Problem Solving

- Fall'20, in Doha, 12 units
- Class of 4 students
- Average of course evaluations: 4.75

4. 15-488 Machine Learning in a Nutshell

- Spring'20 in Doha, 9 units
- Class of 16 students
- Average of course evaluations: 4.51

5. 10-315 Introduction to Machine Learning

- Fall'19 in Doha, 12 units
- Class of 2 students
- Average of course evaluations: 4.89

6. 15-110 Principles of Computing

- Fall'19 in Doha, 10 units
- Class of 12 students
- Average of course evaluations: 3.69

7. 15-382 Collective Intelligence

- Spring'19 in Doha, 9 units
- Class of 1 student
- Course evaluations: Not allowed with one student

8. 15-110 Principles of Computing

- Spring'19 in Doha, 10 units
- Class of 16 students
- Average of course evaluations: 3.52

9. **16-311 Introduction to Robotics**
 - Fall'18, in Doha, 12 units
 - Class canceled after the start (only one student registered)
10. **15-381 Artificial Intelligence: Representation and Problem Solving**
 - Fall'18, in Doha, 9 units
 - Class 2 students
 - Average of course evaluations: 3.67
11. **15-382 Collective Intelligence**
 - Spring'18 in Doha, 9 units
 - Class of 4 students
 - Average of course evaluations: 4.56
12. **16-311 Introduction to Robotics**
 - Fall'17, in Doha, 12 units
 - Class of 2 students
 - Average of course evaluations: Not submitted
13. **15-381 Artificial Intelligence: Representation and Problem Solving**
 - Fall'17, in Doha, 9 units
 - Class of 2 students
 - Average of course evaluations: 5
14. **15-381 Artificial Intelligence: Representation and Problem Solving**
 - Spring'17, in Doha, 9 units
 - Class of 5 students
 - Average of course evaluations: 2.67
15. **15-781 Artificial Intelligence: Representation and Problem Solving**
 - Fall'16, in Pittsburgh, 9 units
 - Class of 15 students
 - Average of course evaluations: 4.63

8.2 Courses Taught Outside Carnegie Mellon

1. Robotics

- Institution: *University of Lugano (USI), Switzerland*
- School: Master in Informatics, Department of Informatics
- When: Spring'16, Spring'15, Spring'14
- Classes: From 5 to of 25 students
- Average of course evaluation: 4/5

2. Operations Research

- Institution: *University of Applied Science of Southern Switzerland (SUPSI)*
- School: Management Engineering
- When: Fall'15, Fall'14, Fall'13, Fall'12
- Classes: From 12 to of 24 students
- Average of course evaluation: 4/5 (Awarded as one of the best SUPSI teachers in Fall'13)

3. Lab of Algorithms and Data Structures

- Institution: *University of Applied Science of Southern Switzerland (SUPSI)*
- School: Computer Engineering
- When: Fall'14
- Classe: 28 students
- Average of course evaluation: 4.1/5

4. Heuristic & Heuristics Lab

- Institution: *University of Lugano (USI), Switzerland*
- School: Master in Intelligent Systems, Department of Informatics
- When: Fall'08, Fall'09, Fall'10, Fall'11, Fall'12
- Classes: From 5 to of 20 students
- Average of course evaluation: 3.85/5

5. Optimization and Process Evaluation

- Institution: *University of Applied Science of Southern Switzerland (SUPSI)*
- School: Management Engineering
- When: Spring'08
- Class: 8 students
- Average of course evaluation: Not available

8.3 Short Courses and Conference Tutorials

1. ***Ant Colony Optimization: theory and hands-on*** (Master of Science in Informatics) - Short course, *Bicocca University*, Milan, Italy, 2013, 8 hours.
2. ***Swarm and collective intelligence*** (Master of Science in Intelligent Systems) - Short course, *University of Lugano (USI)*, Lugano, Switzerland, from 2007 to 2013, 8 hours.
3. ***Ant Colony Optimization and its application to routing in telecommunication networks*** (Conference Tutorial) - "*ANTS'06, 5th International Workshop on Ant Algorithms and Swarm Intelligence*", Brussels, Belgium, September 4–7, 2006, 6 hours.
4. ***Ant Colony Optimization: from innovative research to successful industrial applications*** (Post-grad Summer School) - "*1st Summer School on Aspects of Complexity*", University of Bologna, Bertinoro, Italy, July 18–28, 2005, 12 hours
5. ***Swarm intelligence, nature's way to system engineering*** (PhD in Informatics) - Department of Electronics, Computer Science and Automation, *University of Girona*, Spain, April 26–27, 2005, 12 hours
6. ***Swarm intelligence and metaheuristics for combinatorial optimization*** (Post-grad course on Spatial Intelligence) - Department of Geoinformatics, *Helsinki University of Technology (TKK)*, Finland, August 30 - September 3, 2004, 12 hours.

8.4 Outreach Courses

1. Experience CMU-Q

- CMU-Q, Doha, January 18, 2020; 2 sessions of 2.5 hours each, with 45 to 55 students.
- CMU-Q, Doha, October 26, 2019; 2 sessions of 2.5 hours each, with 45 to 60 students.
- CMU-Q, Doha, January 19, 2019; 2 sessions of 2.5 hours each, with 45 to 60 students.
- CMU-Q, Doha, October 13, 2018; 2 sessions of 2 hours each, with 40 to 60 students.
- *Description:* A workshop intended as a short journey into computer science. Hands-on problem solving on a set of TSP and VRP instances of increasing difficulty, solution testing with the Cozmo robot. Original design of the workshop format.

2. Professional Development Day at CMU-Q for the American School of Doha

- CMU-Q, Doha, October 24, 2018; one session of 1 hour with 12 middle- and high-grade teachers.
- *Description:* A short workshop about teaching computer science by integrating problem solving, programming, and robotics.

3. Robotics Workshop @MindCraft

- CMU-Q, Doha, September 15, September 22, October 6, 2018; 2 sessions of 3 hours each with 40 to 50 students.
- *Description:* Problem solving in computer science and robotics; how to program the Anki Cozmo mobile robot in Python; novel design of multiple robotic challenges, including searching for visual tags or people, navigating using landmarks and line following, navigating using face-following; finding and stacking cubes.

4. Computer Science and Robotics Lab @Winter Institute: Discover computer science

- CMU-Q, Doha, Jan 28 - Feb 1, 2018; 10 hours total, 25 students.
- *Description:* Introduction course for high school students to learn how to program in Python; application to programming a mobile ground robot: safely navigate through a track only using short-range infrared sensors.

5. Robotics Workshop @MindCraft

- CMU-Q, Doha, October 14, 2017; 2 sessions of 3 hours each.
- *Description:* How to program a mobile robot in Python; create a simple navigation map; use of visual input for moving through a track.

6. Computer Science and Robotics Lab @Winter Institute: Discover computer science

- CMU-Q, Doha, Jan 29 - Feb 2, 2017; 10 hours total.
- *Description:* Introduction course for high school students to learn how to program in Python; application to programming a mobile ground robot: safely navigate through a track using a map (built by the students) or short-range infrared sensors.

9 Student Advising

9.1 Completed Ph.D. Students

1. Eduardo Feo-Flushing
 - **Cooperative missions with heterogeneous networked teams**, Dec. 2017
 - Institution: *University of Lugano (USI), Switzerland*
 - Co-advisor: Prof. Luca Gambardella
 - From August 2018, post-doc at CMU-Q
2. Jawad Nagi
 - **Human-swarm symbiotic interaction**, Aug. 2016
 - Institution: *University of Lugano (USI), Switzerland*
 - Co-advisor: Prof. Luca Gambardella
 - Moving from NYC to a Swiss ICT company

9.2 Undergraduate Senior Thesis and Research Projects

1. **Qatar Student Initiated Undergraduate Research Program (QSIURP) project, Advisor:** CMU-Q, Summer 2021. Subject: *Deep learning for automated counting in human crowds and animal swarms*. Student: Ammar Karkour.
2. **QSIURP project, Advisor:** CMU-Q, Summer 2021. Subject: *Reinforcement learning combined with transfer learning for HVAC control in residential and commercial buildings*. Students: Nada Soliman, Abdalla Mohamed.
3. **QSIURP project Advisor:** CMU-Q, Summer 2021. Subject: *Behavioral and Time Modulation of a RL controller using Artificial Emotions*. Student: Samar Rahmouni.
4. **SURA research Advisor:** CMU-Q, Summer 2021. Subject: *Deep distributed reinforcement learning for data mapping tasks using multi-robot systems*. Student: Fangjiao Xu.
5. **Senior Thesis, Co-Advisor:** School of Computer Science, CMU-Q, Doha. Academic year 2017-18. Subject: *Deep learning and pattern analysis for crack detection*. **Best Project Award at the Meeting of the Minds 2018, CMU-Q**. Student: Fatma Tlili.
6. **Senior Thesis, Advisor:** School of Computer Science, CMU-Q, Doha. Academic year 2017-18. Subject: *A mixed initiative system for survivable path planning in unknown cluttered environments* **Best CS Project Award from Qatar National Research Fund (QNRF) at the Meeting of the Minds 2018, CMU-Q**. Student: Rohith Pillai.
7. **Senior Thesis, Co-Advisor:** School of Computer Science, CMU-Q, Doha. Academic year 2017-18. Subject: *A learning approach to vision-based coarse localization in industry*, Student: Aisha Mohamed.
8. **QSIURP project, Advisor:** CMU-Q Summer 2017. Subject: *A distributed approach to multi-robot collision-free vehicle routing in dynamic environments*. Students: Zan Naeem, Mohamed Zakzok.
9. **Independent Study, Co-Advisor:** School of Computer Science, CMU-Q, Doha. Spring semester 2017. Subject: *Developing modern Web applications with best practices*. Student: Yasser Mahmoud Elsayed.

10. **BSc. Thesis in Management Engineering, Co-Advisor:** *Models and algorithms for lot-sizing problems*, 2009. Institution: University of Applied Science of Southern Switzerland, Lugano, Switzerland. Student: Franjo Majstorovic.
11. **Research Internship in Networking, 6 months, Advisor:** *Adaptive routing in networks on-chip*, 2005. Workplace: IDSIA. Student: Neha Bhargava.
12. **BEng. thesis in Electronics Engineering, Co-Advisor:** *Adaptive load balancing in telecommunications networks*, 1998. Institution: Politecnico of Milano, Italy. Workplace: IRIDIA, Belgium. Student: Emanuele Persico.

9.3 M.S. Thesis or M.S. / Ph.D. Research Projects

1. **Student Internship in Robotics, Advisor:** *Decentralized position control of data collectors for multicenter data storage in mobile robotic networks*, 6 months, 2016. Funding Institution: NCCR Robotics, Switzerland. Workplace: IDSIA. Student: Kaviya Dhanabalachandran.
2. **Ph.D. in Informatics, Research Advisor:** *Multi-modal human multi-robot interaction*, starting in 2015, running. Institution: University of Lugano, Switzerland. Work in context of the NCCR Robotics project “Symbiotic interaction between humans and multi-robot systems” (funded by Swiss NSF). Ph.D. student: Boris Gromov.
3. **Research Internship in Mobile Networking, Advisor:** *Dynamic node placement in robotic MANETs*, 4 months, 2014. Funding Institution: University of Granada, Spain. Workplace: IDSIA. Ph.D. Student: Roberto Magán Carrión. Current occupation: Post-doc researcher at Granada University, Spain.
4. **Research Internship in Robotics, Advisor:** *Cooperative monitoring of disaster areas with UAVs teams*, 6 months, 2014. Funding Institution: NCCR Robotics, Switzerland. Workplace: IDSIA. Researcher: Fatemeh Mohseni. Current occupation: Ph.D. student at Linköping University, Sweden.
5. **MSc. thesis in Computer Engineering, Co-Advisor:** *Multi-robot fair target tracking with uncertain observations and mobility prediction*, 2013. Institution: Politecnico of Milan, Italy. Workplace: IDSIA. Student: Jacopo Banfi. Current occupation: Ph.D. student at Politecnico of Milan, Italy.
6. **Ph.D. in Informatics, Research Advisor:** *Resilient path planning for multi-robot systems*, started in 2013, running. Institution: University of Lugano, Switzerland. Work in context of the NCCR Robotics project “Resilient path planning for ground robots” (funded by Swiss NSF). Ph.D. student: Jérôme Guzzi.
7. **MSc. thesis in Informatics, Advisor:** *A cooperative distributed protocol for link quality learning in wireless networks*, 2012. Institution: University of Lugano, Switzerland. Student: Imran Ahmed.
8. **MSc. thesis in Informatics, Advisor:** *Optimal relay node placement for throughput enhancement in wireless sensor networks*, 2010. Institution: joint programme of the Universities of Trento and Aachen. Workplace: IDSIA. Student: Eduardo Feo.
9. **MSc. thesis in Computer Science Engineering, Co-Advisor:** *Swarms of flying robots performing distributed path planning for objects on the ground*, 2010. Institution: Politecnico of Milano, Italy. Workplace: IDSIA. Student: Andreagiovanni Reina. Current occupation: Post-doc researcher at Sheffield University, UK.
10. **MSc. thesis in Bioinformatics, Co-Advisor:** *A computational model for the immune system and its aging*, 1999. Institution: Dept. of Biology, Manchester University, UK. Student: Silvana Valensin.
11. **MSc. thesis in Physics, Co-Advisor:** *Study of the diversity of antibodies using genetic algorithms*, 1994. Institution: University of Bologna, Italy. Student: Silvana Valensin.

9.4 Ph.D. Thesis Committee Service

1. Pedro Veloso

- *School of Architecture, CMU, Pittsburgh*
- **designLOOP: A multi-agent system for architectural composition**
- Started in 12/2016, admitted to dissertation phase in Dec. 2017
- Advisor: Prof. Ramesh Krishnamurti

2. Zhiang Zhang

- *School of Architecture, CMU, Pittsburgh*
- **A reinforcement learning approach for whole building energy model assisted HVAC supervisory control**
- Started in 12/2016, successfully defended the thesis on Sep 11, 2019.
- Advisor: Prof. Khee Poh Lam

9.5 External Examiner for M.S. or Ph.D. Thesis

- Ph.D. thesis, Angelo Trotta: *Next-generation public safety systems based on autonomous vehicles and opportunistic communications*, Università di Bologna, Computer Science and Eng., Italy, April, 2017
- Ph.D. thesis, Milan Erdelj: *Mobile wireless sensor network architecture: Applications to mobile sensor deployment*, Université des Sciences et Technologies de Lille, INRIA Lille, France, Octobre 11, 2013
- M.Sc. thesis, Giuseppe Cuccu: *Variable Size Populations for Dynamic Optimization with Genetic Programming*, Computer Science Department, Università Bicocca, Milan, Italy, February 2008
- Ph.D. thesis, Samih Tadrus: *Generic Multi-Pheromone Quality of Service Routing*, School of Computer Science, University of Nottingham, England, July 2007
- Ph.D. thesis, Luc Hogie: *Delay Tolerant Networks: Modelling, Simulation and Broadcast-based Applications*, Computer Science institute, University of Luxembourg, April 2007

10 University Service

- Participation to a total of four *reappointment / promotion committees* (for Computer Science, Mathematics, and Information Systems departments), 2017, 2018, 2019, 2020
- Participation to *committee for academic trips*, 2018
- Head of the *Research Engagement Committee* (CMU-Q, computer science) 2020-2021.