



## Daniele Catanzaro

Professor of Discrete Optimization  
Center for Operations Research and Econometrics (CORE)  
Université Catholique de Louvain

### Contact Information

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### Synopsis

2017 - Now Professor, Université Catholique de Louvain, **Belgium**  
2014 - 2017 Associate Professor, Univ. Catholique de Louvain, **Belgium**  
2013 - 2014 Assistant Professor, Univ. of Groningen, **The Netherlands**  
2010 - 2012 Visiting Researcher, Carnegie Mellon University, **USA**  
2009 - 2013 Chargé de Recherches du FNRS, **Belgium**  
2004 - 2008 Ph.D. Fellow, Université Libre de Bruxelles, **Belgium**  
1997 - 2003 MSc in CS Eng., Summa cum Laude, Univ. of Palermo, **Italy**

## Overview

I am an applied mathematician and a computer scientist, currently appointed as Professor (Professeur) of Discrete Optimization at the **Center for Operations Research and Econometrics (CORE)** of the **Université Catholique de Louvain**, Belgium. My research interests mainly focus on:

Discrete Optimization	Polyhedral combinatorics; integer linear and nonlinear programming; computational complexity; submodularity; impact of ordering in discrete optimization; optimization on lattices; majorization; network design; quadratic assignment; optimization under uncertainty; large scale enumeration problems; design and development of large scale exact and approximate solution algorithms for practical problems.
Optimization Methods for ML	Clustering; regression; support vector machine methods; specific optimization aspects related to deep reinforcement learning.
Algorithms, Information Theory & HPC	Design and development of algorithms for combinatorial problems on graphs; subgraph and supergraph problems; mathematical results in combinatorics and graph theory; constructive characterizations of the solutions to specific combinatorial optimization problems on graphs. Massively parallel search algorithms; high performance computing; specific topics in data compression and encryption; information theory.
Phylogenetics, Tumor Evolution & Medical Bioinformatics	Distance methods in phylogenetics; Design of ad hoc estimation models for molecular evolution and phylogenetics; consistency analysis; combinatorics of phylogenetics; information entropy in phylogenetics; cancer phylogenetics. Design of mathematical models and estimation algorithms for genome-wide association studies.

From 2017 to 2019, I served the Faculty Board of the Louvain School of Management as a Chair of the Commission for the Bachelor Curriculum in Management Science and Business Engineering. I cared of the internal quality assessment of this curriculum (AEQES) and I promoted its reform. I joined again the same commission in September 2020 as a member of the commission.

The PDF version of this document includes a table of contents, bookmarks, and hyperlinks (highlighted in **red**).

## Education & Academic Experience

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- 08.2020 – Present Professor (Professeur) of Discrete Optimization at the Center for Operations Research and Econometrics (CORE) of the Université Catholique de Louvain (UCL).
- 02.2020 – 02.2020 Invited Researcher at the Institute for Systems Analysis and Computer Science of the Italian National Research Council (CNR), Rome, Italy.
- 05.2019 – 12.2020 Senior Research Leader in Digital Transformations at the Luxembourg Institute for Socio-Economic Research (LISER), the Grand Duchy of Luxembourg.
- 02.2018 – 03.2018 Invited Professor of Operations Research at the Department of Management of the University Ca Foscari of Venice, Italy.
- 05.2017 – 12.2019 Chair of the Commission for the Bachelor Curriculum in Management Science and Business Engineering, Louvain School of Management, Université Catholique de Louvain (UCL).
- 05.2017 – 09.2020 Associate Professor (Chargé de Cours à titre définitif) of Discrete Optimization at the Center for Operations Research and Econometrics (CORE) of the Université Catholique de Louvain (UCL).
- 09.2014 – 05.2017 Assistant Professor (Chargé de Cours à titre temporaire) of Discrete Optimization at the Center for Operations Research and Econometrics (CORE) of the Université Catholique de Louvain (UCL).
- 02.2013 – 08.2014 Assistant Professor of Discrete Optimization at the Department of Operations of the Faculty of Economics and Business of the University of Groningen, The Netherlands.
- 03.2012 – 08.2012 Visiting Researcher at the Department of Biological Sciences of the Carnegie Mellon University, USA. I collaborated with [R. Schwartz](#) to develop mixed integer programming models to profile tumor progression over time via single-cell sequencing.
- 11.2010 – 04.2011 Visiting Researcher at the Tepper School of Business and at the Department of Biological Sciences of the Carnegie Mellon University, USA. I collaborated with [R. Ravi](#) and [R. Schwartz](#) to develop mixed integer programming models for the Steiner tree problem in the hypercube.
- 06.2010 – 06.2010 Visiting researcher at the Department of Computer Science and Biomedical Engineering of Reykjavik University, Iceland. I collaborated with [Bjarni V. Halldórsson](#) to develop mixed integer programming models for covering and coloring problems on specific classes of interval graphs.
- 05.2010 – 05.2010 Visiting researcher at the Department of Mathematics and Computer Science of the Freie Universität Berlin, Germany. Aim of the visit: increasing knowledge on inverse optimization problems related to metabolic networks at [A. Bockmayr](#)'s lab.
- 10.2009 – 09.2013 Postdoctoral Researcher of the Belgian National Fund for Scientific Research (FRS-FNRS) affiliated to the Graphs and Mathematical Optimization Unit of the Computer Science Department of the ULB, Belgium.
- 02.2009 – 04.2009 Visiting Researcher at the Department of Statistics and Operations Research of the University of La Laguna, Spain. I collaborated with [J. J. Salazar-González](#) to develop mixed integer programming models for particular network design problems over a lattice of unrooted binary trees.
- 10.2004 – 10.2008 PhD candidate at the Unit of Graphs and Mathematical Optimization of the Université Libre de Bruxelles (ULB). My focus was on the study of specific network design and covering problems on specific classes of graphs arising from molecular phylogenetics and disease association studies. As a major contribution, I developed the current state-of-the-art MIP model for haplotype estimation under pure parsimony, characterized special classes of edge path incidence matrices of trees, and investigated the fundamental equations that describes unrooted binary trees (phylogenies). During my doctoral studies I spent 3 years at the Institute

of Medicine and Molecular Biology of the ULB. I obtained the title of Doctor in Sciences under the supervision of **M. Labbé**.

The committee for the doctoral defense included: **Michel Gendreau** (Polytechnic of Montreal), **Bernard Fortz** (ULB), **Raffaele Pesenti** (University of Venice), **Guy Latouche** (ULB), and **Patrick Mardulyn** (ULB).

During my doctoral studies I achieved a number of scientific results published in A09-A010; A17; A20-A22; and R02.

My doctoral studies have been supported (from 10.2005 to 09.2009) by the Belgian National Fund for Scientific Research (FRS-FNRS) via the prestigious grant “Aspirant FNRS”.

09.2003 – 09.2004 Marie Curie Fellow at IRIDIA, ULB. Grant HPRN-CT-1999-00106. Senior scientist in charge: **M. Dorigo**. My focus was on the design, implementation and tuning of metaheuristics for network design and timetabling problems.

09.1997 – 04.2003 Laurea in Computer Science Engineering, Summa cum Laude, University of Palermo, Italy, under the supervision of **R. Pesenti**. Subject of the master thesis: The timetabling problem. During the academic year 2002-2003 I had the possibility to perform extra muros studies at the Polytechnic University of Valencia, Spain, in the context of the Erasmus project.

## Grants, Honorary Fellowships & Qualifications

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During my doctoral and postdoctoral research activity I obtained the following grants and honorary fellowships:

USA	Visiting grant (9000\$) funded by the Carnegie Mellon University (CMU) via the U.S. National Institutes of Health awards 1R01CA140214 and 1R01AI076318. The grant contributed to cover the visit at the CMU during the period November 2010 – April 2011.
Belgium	Belgian American Educational Foundation (BAEF) Honorary Fellowship 2010-2011 for biomedical engineering researches in the USA. November 2010 – April 2011.
Belgium	Visiting grant (1000€) funded by the European Union COST Action. The grant covered the visit at the AGP lab of the Faculty of Sciences of the University of Geneva, Switzerland, during October 2010.
Belgium	Prize <i>Fonds Brachet</i> (1000€) funded by the Institute of Medicine and Molecular Biology (IBMM) of the ULB. The grant covered the expenses for the meeting <i>Future Directions in Phylogenetic Methods and Models</i> at the Isaac Newton Institute for Mathematical Sciences, Cambridge, United Kingdom, on December 17-21 2007.

I hold the following

Academic Qualifications	2020	Abilitazione Scientifica Nazionale per Professore di Fascia I in Ricerca Operativa (Italian National Scientific Qualification for Full Professor of Operations Research).
	2017	Abilitazione Scientifica Nazionale per Professore di Fascia II in Ricerca Operativa (Italian National Scientific Qualification for Associate Professor of Operations Research).
	2012	Maitre de Conférence (Assistant Professor) in France for Sections 26 (Applied Mathematics) and 27 (Computer Science).
Memberships & Equivalences	2004	Qualification as Belgian Civil Engineer.
	2003	National Qualification for the Italian Engineering Society.

## Research Funds

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During my research activity I rose an overall amount of **311,500** euros via the following research projects:

2018-2021	Title	COALESCENS, predictive models for precision oncology.
	Funds	140,000 euros.
	Source	Fondation Louvain, Université Catholique de Louvain.
	Role	Principal Investigator.
2017-2021	Title	Optimizing over unrooted binary tree: Bridging the gap between phylogenetics and coding theory
	Funds	151,000 euros.
	Source	Université Catholique De Louvain via the “Fonds Speciaux de Recherche 2017”.
	Role	Principal Investigator.
	Scope	This fund has supported Martin Frohn’s doctoral studies.
2017-2018	Title	Optimizing over unrooted binary tree.
	Funds	20,500 euros.
	Source	The Belgian National Fund for Scientific Research (FRS-FNRS) via the grant “Crédit de Recherche” ref. S/25-MCF/OL J.0026.17.
	Role	Principal Investigator.

## Scientific Production

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Category	Published and Accepted Articles in International Scientific Journals
Network Design / Phylogenetics	<p>A01. D. Catanzaro, R. Pesenti, and L. Wolsey. <i>On the Balanced Minimum Evolution Polytope</i>. Discrete Optimization, accepted, 2020. Contribution: I contributed to conceive the work and to write the article, implemented the models/algorithms, and performed computations. Part of this work has been presented at ISMP 2018.</p> <p>A02. D. Catanzaro and R. Pesenti. <i>Enumerating Vertices of the Balanced Minimum Evolution Polytope</i>. Computers and Operations Research, 109, 209-217, 2019. Contribution: I contributed to conceive the work and to write the article, implemented the models/algorithms, and performed computations.</p> <p>A03. D. Catanzaro, S. E. Shackney, A. A. Schäffer, and R. Schwartz. <i>Classifying the progression of ductal carcinoma from single-cell sampled data: A case study</i>. IEEE/ACM Transactions in Computational Biology and Bioinformatics, 13(4):643–655, 2016. Contribution: I contributed to conceive the work and to write the article, implemented the models/algorithms, and performed computations.</p> <p>A04. D. Catanzaro, R. Aringhieri, M. Di Summa, and R. Pesenti. <i>A branch-price-and-cut algorithm for the minimum evolution problem</i>. European Journal of Operational Research, Accepted, 2015. Contribution: I contributed to conceive the work and to write the article, implemented the models/algorithms, and performed computations.</p> <p>A05. D. Catanzaro, R. Ravi, and R. Schwartz. <i>A mixed integer linear programming model to reconstruct phylogenies from single nucleotide polymorphism fragments under the maximum parsimony criterion</i>. BMC Algorithms for Molecular Biology, 8:3, 2013. Contribution: I contributed to conceive the work and to write the article, implemented the models/algorithms, and performed computations.</p> <p>A06. D. Catanzaro, M. Labbé, R. Pesenti, and J. J. Salazar-González. <i>The balanced minimum evolution problem</i>. INFORMS Journal on Computing, 24(2), 276-294, 2012. Contribution: I contributed to conceive the work and to write the article, implemented the models/algorithms, and performed computations. This article describes the current state-of-the-art MIP model for the BMEP.</p>

- A07. R. Aringhieri, D. Catanzaro, and M. Di Summa. *Optimal solutions for the balanced minimum evolution problem*. Computers and Operations Research, 38(12), 1845–1854, 2011.  
Contribution: I contributed to conceive the work and to write the article.
- A08. D. Catanzaro, E. Gourdin, M. Labbé, and F. A. Özsoy. *A branch-and-cut algorithm for the partitioning-hub location-routing problem*. Computers and Operations Research 38(2), 539–549, 2011.  
Contribution: I contributed to conceive the work and to write the article, implemented the models/algorithms, and performed computations.
- A09. D. Catanzaro, M. Labbé, R. Pesenti, and J. J. Salazar-González. *Mathematical models to reconstruct phylogenetic trees under the minimum evolution criterion*. Networks 53(2), 126–140, 2009.  
Contribution: I contributed to conceive the work and to write the article, implemented the models/algorithms, and performed computations.
- A10. D. Catanzaro. *The minimum evolution problem: Overview and classification*. Networks 53(2), 112–125, 2009.  
Contribution: I conceived the work and wrote the article.
- Covering  
& Coloring /  
Genome-wide  
Association  
Studies
- A11. L. Porretta, D. Catanzaro, B. V. Halldórsson, and B. Fortz. *Branch&Price Algorithm for the Minimum Cost Clique Cover Problem in Max-Point Tolerance Graphs*. 4OR, 17(1), 75-96, 2019.
- A12. D. Catanzaro and C. Engelbeen. *An integer linear programming formulation for the minimum cardinality segmentation problem*. Algorithms 2015, 8(4), 999-1020, 2015.  
Contribution: I contributed to conceive the work and to write the article, implemented the models/algorithms, and performed computations.
- A13. D. Catanzaro, M. Labbé, and B. V. Halldórsson. *An integer programming formulation of the parsimonious loss of heterozygosity problem*. IEEE/ACM Transactions in Computational Biology and Bioinformatics, 10(6), 1391-1402, 2013.  
Contribution: I contributed to conceive the work and to write the article, implemented the models/algorithms, and performed computations.
- A14. D. Catanzaro, M. Labbé, and L. Porretta. *A class representative model for pure parsimony haplotyping under uncertain data*. PLoS One 6(3): e17937, 2011.  
Contribution: I contributed to conceive the work and to write the article.
- A15. D. Catanzaro, M. Andrien, M. Labbé, and M. Toungouz-Nevešsignsky. *Computer-aided human leukocyte antigen association studies: A case study for psoriasis and severe alopecia areata*. Human Immunology 71(8), 783–788, 2010.  
Contribution: I contributed to conceive the work and to write the article, implemented the models/algorithms, and performed computations.
- A16. D. Catanzaro, A. Godi, and M. Labbé. *A class representative model for pure parsimony haplotyping*. INFORMS Journal on Computing 22(2), 195–209, 2010.  
Contribution: I contributed to conceive the work and to write the article, implemented the models/algorithms, and performed computations. This article describes the current state-of-the-art IP model for the PPHP.
- A17. D. Catanzaro and M. Labbé. *The pure parsimony haplotyping problem: Overview and computational advances*. International Transactions in Operational Research 16(5), 561–584, 2009 (Invited article).  
Contribution: I contributed to conceive the work and to write the article.
- Robust  
Optimization
- A18. D. Catanzaro, M. Labbé, and M. Salazar-Neumann. *Reduction approaches for robust shortest path problems*. Computers and Operations Research, 38(11), 1610–1619, 2011.  
Contribution: I contributed to conceive the experiments and to write the article.
- A19. D. Catanzaro, M. Labbé, and R. Pesenti. *The balanced minimum evolution problem under uncertain data*. Discrete Applied Mathematics, 161(13-14), 1789-1804, 2013.  
Contribution: I contributed to conceive the work and to write the article, implemented the models/algorithms, and performed computations.

**Overview of the scientific production**

	Area	Name of the Journal	Number of Articles
<b>International Journals</b>	Operations Research	European Journal of Operational Research	2
		Computers and Operations Research	4
		INFORMS Journal on Computing	2
		International Transact. in Operational Research (Invited Art.)	1
		Networks	2
		Discrete Applied Mathematics	2
		Discrete Optimization	1
		Operations Research Letters	1
		Optimization Letters	1
		Algorithms	1
	4OR	1	
	Bioinformatics	Bioinformatics	1
		PLoS One	1
		BMC Evolutionary Biology	1
		Human Immunology	1
		Evolutionary Bioinformatics	1
		IEEE/ACM Trans. in Computational Biology and Bioinf.	2
BMC Algorithms for Molecular Biology	1		
<b>Bibliometrics</b>	Total number of articles on international journals	26	
	Scopus	<a href="#">Click here</a>	
	Google Scholar	<a href="#">Click here</a>	
	Thomson Reuters	<a href="#">Click here</a>	
<b>Authorship Information</b>	Number of articles as a single author	1	
	Number of articles as a first author	21	
	Number of articles without PhD supervisor	15	
<b>Minor Works</b>	Theses	3	
	Book Chapters	1	
	Technical Reports	3	
	Conference Proceedings	2	
	Posters in Conferences	2	
<b>Talks</b>	International Conferences	25	
	Invited Talks	34	

- Heuristics A20. D. Catanzaro, R. Pesenti, and M. C. Milinkovitch. *An ant colony optimization algorithm for phylogenetic estimation under the minimum evolution principle*. BMC Evolutionary Biology 7:228, 2007.  
Contribution: I contributed to conceive the work and to write the article, implemented the models/algorithms, and performed computations. Highly accessed.
- Systems Theory / Models of Molecular Evolution A21. D. Catanzaro, R. Pesenti, and M. C. Milinkovitch. *A non-linear optimization procedure to estimate distances and instantaneous substitution rate matrices under the GTR model*. Bioinformatics 22(6), 708–715, 2006.  
Contribution: I contributed to conceive the work and to write the article, implemented the models/algorithms, and performed computations.
- A22. L. Gatto, D. Catanzaro, and M. C. Milinkovitch. *Assessing the applicability of the GTR model through simulations*. Evolutionary Bioinformatics 2, 153–163, 2006.  
Contribution: I contributed to conceive the work and to write the article, implemented the models/algorithms, and performed computations.
- Routing A23. D. Catanzaro, M. Labbé and L. E. N. Gouveia. *Improved Integer Linear Programming Formulations for the Job Sequencing and Tool Switching Problem*. European Journal of Operational Research, 244(3), 766–777, 2015.  
Contribution: I contributed to conceive the work and to write the article, implemented the models/algorithms, and performed computations.
- Graph Theory A24. D. Catanzaro, S. Chaplick, S. Felsner, B. V. Halldórsson, M. M. Halldórsson, T. Hixon and J. Stacho. *Max Point-Tolerance Graphs*. Discrete Applied Mathematics, 216(1): 84–97, 2017.  
Contribution: I contributed to conceive the work and to write the article.

- Information Theory A25. D. Catanzaro, M. Frohn, and R. Pesenti. *An information theory perspective on the Balanced Minimum Evolution Problem*. Operations Research Letters, 48(3): 362-367, 2020. Part of this work has been presented at ISMP 2018.
- Cutting Plane Methods A26. D. Catanzaro, S. Coniglio, and F. Furini. *Separating cover inequalities of maximum depth*. Optimization Letters, 2021, to appear.

### Journal Articles Submitted or in Preparation

- Submitted S01. D. Catanzaro, M. Frohn, O. Gascuel, and R. Pesenti. A Tutorial on the Balanced Minimum Evolution. European Journal of Operational Research, December 2020. Invited article.
- S02. H. Dehaybe, D. Catanzaro, and P. Chevalier. A Deep Reinforcement Learning approach for the Stochastic Inventory Problem. Operations Research, February 2021.
- Working Papers W01. D. Catanzaro, M. Frohn, R. Pesenti. A massively parallel exact solution algorithm for the Balanced Minimum Evolution Problem.
- W02. D. Catanzaro, R. Pesenti, R. Ronco. A new fast and accurate solution approach for the automatic scene detection problem.
- W03. D. Catanzaro and R. Pesenti. The Pure Parsimony Estimation Problem. To be submitted, 2019.
- Long Term Researches LT01. D. Catanzaro. Greed and majorization in discrete optimization.

### Chapters in Books, Theses, Conference Proceedings and Other Publications

- Chapters in Books BC01. D. Catanzaro. *Estimating phylogenies from molecular data*. In *Mathematical approaches to polymer sequence analysis and related problems*, R. Bruni (Editor), Springer, New York, 2010. ISBN: 978-1-4419-6799-2.  
Contribution: I conceived the work and wrote the chapter.
- Theses & Dissertations TD01. D. Catanzaro. *Models and methods in molecular phylogenetics*. Ph.D. thesis, Université Libre de Bruxelles (ULB), Belgium. October 2008.
- TD02. D. Catanzaro. *Metaheuristic approaches for inferring phylogenies*. Diplôme d'Etudes Approfondies en Sciences Appliquées (D.E.A.), Université Libre de Bruxelles (ULB), Belgium. September 2004.
- TD03. D. Catanzaro. *An automated course scheduling system based on tabu search*. Tesi di Laurea in Ingegneria Informatica, Università degli studi di Palermo, Palermo, Italia. April 2003.
- Technical Reports TR01. D. Catanzaro, R. M. V. Figueiredo, and M. Labbé. *The maximum k-balanced subgraph of a signed graph*. Discrete Applied Mathematics.  
Contribution: I contributed to conceive the work and to write the article, implemented the models/algorithms, and performed computations.
- TR02. D. Catanzaro, R. Pesenti, and M. C. Milinkovitch. *Estimating phylogenies under maximum likelihood: A very large-scale neighborhood approach*. Technical Report 583, G.O.M., Université Libre de Bruxelles (ULB), Belgium, February 2008.
- TR03. D. Catanzaro. *Metaheuristic approaches for inferring phylogenies*. Technical Report TR-2004-2, IRIDIA, Université Libre de Bruxelles (ULB), Belgium, September 2004.
- Conference Proceedings CP01. D. Catanzaro, M. Labbé, and B. V. Halldórsson. *A mixed integer programming model for the parsimonious loss of heterozygosity problem*. Proceedings of ISBRA 2012 (LNBI 7292).
- CP02. D. Catanzaro, M. Andrien, M. Labbé, and M. Toungouz-Nevevessnysky. *Mathematical models for HLA association studies: A case study for psoriasis and severe alopecia areata*. Proceedings of EFI 2009, Tissue Antigens 73(5), 399-400, 2009.

- Posters in  
Conferences
- PC01. Benelux Bioinformatics Conference, Center for Computational Systems Biology, Catholic University Leuven, Leuven, Belgium, on November 12-13 2007.
- PC02. Mathematics for Evolution and Phylogeny (MEP 05), Institut Henry Poincaré, Paris, France, on June 17-21 2005.

### Conferences, Seminars, and Invited Talks

- Talks in Int.  
Conferences
- TC01. 6th International symposium on Combinatorial Optimization (ISCO 2020), co-located with Optimization Days 2020, Montreal, Canada, May 4-6, 2020. Cancelled due to CoVID19.
- TC02. Workshop on Integer and Combinatorial Optimization, RWTH Aachen, Aachen, March 11-12, 2020. Cancelled due to CoVID19.
- TC03. 30th European Conference on Operational Research (EURO) 2019, Dublin, Ireland, on June 23-26, 2019.
- TC04. 23st International Symposium on Mathematical Programming (ISMP 2018), Bordeaux, France, on July 1-6 2018. Session Chair.
- TC05. International Conference 2018 on Applied Combinatorial Optimization (EURO/ALIO 2018), Bologna, Italy, on June 25-27 2018.
- TC06. CORE@50 Conference, Center for Operations Research and Econometrics, Louvain-la-Neuve, Belgium, on May 23-27, 2016.
- TC07. 30th Annual Conference of the Belgian Operations Research Society, Louvain la Neuve, Belgium, on January 28-29, 2016.
- TC08. 22st International Symposium on Mathematical Programming (ISMP 2015), Pittsburgh, PA on July 12-17 2015. Session Chair.
- TC09. 26th European Conference on Operational Research (EURO) 2013, Rome, Italy, on July 1-4, 2013.
- TC10. Journées Graphes et Algorithmes 2012 (JGA), Clermont-Ferrand, France, on November 14-16, 2012. Invited Talk.
- TC11. 2th Bio-Optimization Workshop: Optimization techniques applied to biology, Lisbon, Portugal, on September 22, 2012. Plenary Talk.
- TC12. Computational Biology, Bioinformatics and Medicine (EURO-CBBM), University of Nottingham, Nottingham, United Kingdom, on September 13-15, 2012.
- TC13. 21st International Symposium on Mathematical Programming (ISMP 2012), Berlin, Germany, on August 19-24 2012.
- TC14. International Symposium on Bioinformatics Research and Applications (ISBRA 2012), Dallas, Texas, on May 21-23, 2012.
- TC15. 26th Annual Conference of the Belgian Operations Research Society, Brussels, on February 2-3, 2012.
- TC16. Bio-Optimization Workshop: Optimization techniques applied to biology, Coimbra, Portugal, on June 25 2011. Plenary Talk.
- TC17. 24th European Conference on Operations Research (EURO XXIV), Lisbon, Portugal, on July 11-14 2010.
- TC18. International Workshop on Combinatorial Optimization (Aussois 2010), Aussois, France, on January 3-9 2010.
- TC19. 20th International Symposium on Mathematical Programming (ISMP 2009), Chicago, Illinois, on August 23-28 2009.
- TC20. 23th European Immunogenetics and Histocompatibility Conference (EFI) 2009, Ulm, Germany, on May 09-12 2009.
- TC21. Computational Biology, Bioinformatics and Medicine (EURO-CBBM), Consiglio Nazionale delle Ricerche (CNR), Rome, Italy, on September 15-17 2008.



- TC22. 7th Cologne-Twente Workshop on Graphs and Combinatorial Optimization, Università degli Studi di Milano, Gargnano, Italy, on May 13-15 2008.
- TC23. International Symposium on Combinatorial Optimization 2008, University of Warwick, Warwick, United Kingdom, on March 16-19 2008. Session Chair.
- TC24. Future Directions in Phylogenetic Methods and Models, Isaac Newton Institute for Mathematical Sciences, Cambridge, United Kingdom, on December 17-21 2007.
- TC25. 9th Evolutionary Biology Meeting, Marseille, France, on September 21-23 2005.

Seminars  
& Invited  
Talks

- IT01. 1ère journée ROADEF et ORBEL, joined annual meeting of ROADEF and ORBEL, February 1, 2020. Workshop held online due to COVID19 restrictions.
- IT02. Istituto di Analisi dei Sistemi ed Informatica “Antonio Ruberti” (IASI-CNR), Roma, Italy, February 26, 2020.
- IT03. IB2, Univerité Libre de Bruxelles - Vrij Universiteit Brussel, Brussels, Belgium, April 22, 2016.
- IT04. Department of Computer Science, University of Palermo, Palermo, Italy, February 12, 2015.
- IT05. Ludwig Institute for Cancer Research, De Duvé Institute, Université Catholique de Louvain, Brussels, Belgium, February 5, 2015.
- IT06. Center for Operations Research and Econometrics (CORE), Université Catholique de Louvain, Louvain-la-Neuve, Belgium, October 28, 2014.
- IT07. Department of Applied Mathematics, SINTEF, Oslo, Norway, on November 8, 2013.
- IT08. CODeS - KAHO Sint-Lieven, Catholic University Leuven, Gent, Belgium, on August 23, 2013.
- IT09. Operations Research Unit, Polytechnic of Mons, Belgium, on June 8, 2013.
- IT10. Computer Science Department, Polytechnic of Lille, France, on May 13, 2013.
- IT11. Computer Science Department, University of South Denmark, Odense, Denmark, on February 12, 2013.
- IT12. Unit of Bioinformatics and Sequence Analysis, INRIA Lille - Nord Europe, France, on December 4, 2012.
- IT13. CODeS - KAHO Sint-Lieven - KU Leuven, Gent, Belgium, on December 3, 2012.
- IT14. Department of Computer Science, King’s College London, UK, on November 6, 2012.
- IT15. Laboratoire d’Informatique, de Robotique et de Microélectronique de Montpellier (LIRMM)-CNRS, Montpellier, France, on October 3, 2012.
- IT16. Center of Genomic Science, Italian Institute of Technology, Milan, Italy, on September 19, 2012.
- IT17. Faculty of Economics and Business, University of Groningen, Groningen, The Netherlands, on September 17, 2012.
- IT18. Department of Biological Sciences, Carnegie Mellon University, Pittsburgh, PA, USA, on June 5, 2012.
- IT19. Bioinformatics Research Center and Department of Economics and Business, Aarhus Universitet, Aarhus, Denmark, on October 20-21, 2011.
- IT20. School of Mathematics, University of Southampton, Southampton, UK, on May 30th - June 1, 2011.
- IT21. Department of Industrial Engineering and Operations Research, Columbia University, New York, NY, on April 26, 2011.
- IT22. Tepper School of Business, Carnegie Mellon University, Pittsburgh, PA, USA, on April 8, 2011.
- IT23. Department of Computer Science, Reykjavik University, Reykjavik, Iceland, on June 10, 2010.

- IT24. Department of Mathematics and Computer Science, Freie Universität Berlin, Germany, on June 2, 2010.
- IT25. Computational Evolutionary Genomics Group, University Medical Center (C.M.U.), Department of Medicine, Swiss Institute for Bioinformatics (S.I.B.), Geneva, Switzerland, on June 22, 2009.
- IT26. Computer Science Department, Università degli studi di Torino, Turin, Italy, on June 16, 2009.
- IT27. Bioinformatics Research Group, Department of Electrical Engineering (ESAT/SCD), Catholic University Leuven, Belgium, on November 5, 2008.
- IT28. OptLab, Department of Information Technologies, University of Milan, Crema, Italy, on May 17, 2008.
- IT29. Centro de Investigação Operacional, Faculdade de Ciências, Universidade de Lisboa, Lisbon, Portugal, on February 10-12, 2008.
- IT30. Institut de Recherches Interdisciplinaires et de Développements en Intelligence Artificielle (IRIDIA), Université Libre de Bruxelles (ULB), Belgium, on March 20, 2007.
- IT31. 13th Mathematical Programming Meeting - 3<sup>rd</sup> FNRS cycle, Han-sur-Lesse, Belgium, on March 22-23, 2007.
- IT32. CINBIOS (Centre de BioInformatique et BioModelisation) meeting, Department of Computer Science, Université Libre de Bruxelles, Belgium, on September 29, 2006.
- IT33. Computer Engineering and Networks Laboratory (TIK), E.T.H. Zurich, Switzerland, on October 7, 2004.
- IT34. Metaheuristics Network Final Meeting, Edinburgh, UK, on June 27-29, 2004.

## Scientific Collaborations (Partial list)

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- Academic Collaborations
- Raffaele Pesenti**, Department of Applied Mathematics, University 'Ca Foscari of Venice, Italy. R. Pesenti was my master thesis supervisor and is one of my most active collaborators. Our joined efforts gave rise to the articles A04; A06; A09; A19; A20; A21; R02;
- R. Schwartz**, Department of Biological Sciences and Department of Computational Biology of Carnegie Mellon University, USA. Our joined efforts gave rise to A05 and S03.
- R. Ravi**, Tepper School of Business of Carnegie Mellon University, USA. Our joined efforts gave rise to A05.
- Bjarni V. Halldórsson**, Department of Computer Science and Biomedical Engineering of Reykjavik University, Iceland. Our joined efforts gave rise to A011, A13 and A24.
- Magnur Mar Halldórsson**, School of Science and Engineering, Reykjavik University, Iceland. Our joined efforts gave rise to A24.
- Luis Eduardo Neves Gouveia**, Department of Statistics and Operations Research, University of Lisbon, Portugal. Our joined efforts gave rise to the article A23;
- Laurence Wolsey**, Center for Operations Research and Econometrics (CORE), Catholic University of Louvain, Belgium. Collaboration in progress;
- Dr. Marco di Summa**, Department of Applied Mathematics, University of Padua, Italy. Our joined efforts gave rise to the articles A07 and A04.
- J. J. Salazar-González**, Department of Statistics and Operations Research of the University of La Laguna, Spain. Our joined efforts gave rise to A06 and A09.
- Alejandro A. Schäffer**, Computational Biology Branch of NCBI, NIH, Bethesda, MD, USA. Our joined efforts gave rise to the articles S03;
- Roberto Aringhieri**, Department of Computer Science, University of Turin, Italy. Our joined efforts gave rise to the articles A04 and A07.

## Editorial and Organizational Activities

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As of May 2021, I am part of the Advisory Board of the International Journal “Mathematical Methods in Economics and Finance”. I was among the organizers of the 26th Annual Conference of the Belgian Operations Research Society (ORBEL 2012) as well as of the Journées Franciliennes de Recherche Opérationnelle 2021 (joined annual meeting of both the French Operational Research Society Société (ROADEF) et la Belgian Operational Research Society (ORBEL). Moreover, I frequently serve as a referee for numerous international journals and conferences, including (the list may be not updated):

OR Journals	Discrete Applied Mathematics, INFORMS Journal on Computing, Networks, Mathematical Reviews, Journal of Discrete Optimization, Computers and Operations Research, European Journal of Operational Research, 4OR, Journal of Genetic Programming and Evolvable Machines, International Transactions in Operational Research, Information Processing Letters.
Bioinformatics Journals	Bioinformatics, PLoS One, IEEE/ACM Transactions on Computational Biology and Bioinformatics, Journal of Computational Biology, Genetics and Molecular Biology, Evolutionary Bioinformatics, Tissue Antigens.
International Conferences	4th International Workshop on Hybrid Metaheuristics (HM07) 2007, International Network Optimization Conference (INOC) 2009, 25th European Workshop on Computational Geometry (ECG09) 2009, European Conference on Computational Biology 2010, Learning and Intelligent Optimization Conference (LION6) 2012, International Conference on Research in Computational Molecular Biology (RECOMB 2012), Workshop on Algorithms for Bioinformatics (WABI 2012), The International Symposium on Bioinformatics Research and Applications (ISBRA 2012), 3rd International Symposium on Combinatorial Optimization (ISCO 2014).
Institutions	The Belgian national fund for scientific research, the Romanian national research council, and the European Union (Horizon 2020 Programme, DIGI-B-CUBE).

## Teaching Experience

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I am (or I have been) in charge for the following bachelor and master courses:

Date	Label	Synopsis
2019-Now	UCL-TC01	<b>Production Management and Modeling.</b> Louvain School of Management (LSM), <b>UCL</b> , Belgium. ETCS: 5. Theory: 30h; Level: Master. Language: English. Description: Facility Location including aspects related to capacity, service level, multi-echelon, multi-product. Advanced models for demand estimation. Scheduling, cutting stock, bin packing, planning and routing problems.
2017-Now	UCL-TC03	<b>Optimization.</b> Louvain School of Management (LSM), <b>UCL</b> , Belgium. ETCS: 5. Theory: 30h; Exercises: 15h. Level: Bachelor. Language: English. Description: Part I (Continuous Optimization): Continuity, differentiability in n dimension, conditions for differentiability, necessary conditions for optimality, convex sets, convex functions, convex optimization problems, Lagrangian duality, gradient descent algorithms, rudiments of smooth and non-smooth nonlinear optimization; Part II (Discrete Optimization): Formulations; optimality, relaxation, and bounds; relationships between relaxations; efficient optimization property; total unimodularity and efficient convex hull property; strong duality property; efficient separation property; matchings and assignments; introduction to branch-and-bound.
2014-Now	UCL-TC04	<b>Quantitative Decision Making.</b> Louvain School of Management (LSM), <b>UCL</b> , Belgium. ETCS: 5. Theory: 30h; Exercises: 0h. Level: Master. Language: English. Description: integer linear systems: projection and inverse projection; projection: Benders decomposition; inverse projection: Dantzig-Wolfe decomposition; recall of Lagrangian duality; cutting plane algorithms; strong valid inequalities; branch-and-cut; capital budgeting; portfolio optimization; Internet combinatorial auctions; introduction to integer optimization methods for machine learning.

- UCL-TC05 **Supply Chain Management**. Louvain School of Management (LSM), **UCL**, Belgium. ETCS: 5. Theory: 30h; Exercises: 0h. Level: Master. Language: English/French. Description: Part I (Foundation of strategic supply chain network design): value of supply chain network modeling, intuition building with center of gravity models, locating facilities using a distance-based approach, alternative service levels and sensitivity analysis, adding capacity to the model, adding costs to two echelon supply chains, adding outbound transportation to the model, introducing facility fixed and variable costs, baseline and optimal baselines; Part II (advanced modeling including the extension to multiple echelons): three echelon supply chain modeling, adding multiple products and multi-site production sourcing, multi-objective optimization, how to get industrial strength results, data aggregation in network design, case studies.
- UCL-TC06 **Coding Project (Projet de Programmation)**. Louvain School of Management (LSM), **UCL**, Belgium. ETCS: 5. Theory: 30h; Exercises: 15h. Level: Master. Language: English/French. Description: Fundamental data structures, introduction to graph theory, recursion, exploring and searching on graphs, dynamic programming part I (well solved optimization problems in management science: spanning trees), dynamic programming part II (well solved optimization problems in management science: shortest paths), dynamic programming part III (well solved optimization problems in management science: network flows), dynamic programming part IV (well solved optimization problems in management science: matching), hard optimization problems in management science part I (finding the optimum via enumeration), hard optimization problems in management science part II (heuristics, local searches and metaheuristics).
- 2018-2019 UCL-TC01 **Integer Programming and Combinatorial Optimization (former L. Wolsey's Course)**. Ecole Polytechnique de Louvain (EPL), **UCL**, Belgium. ETCS: 5. Theory: 30h; Exercises: 22.5h. Level: Master. Language: English. Description: Formulations; optimality, relaxations and bounds; relationships between relaxations; efficient optimization property; total unimodularity and efficient convex hull property; strong duality property; efficient separation property; matchings and assignments; branch-and-bound; strong inequalities and branch-and-cut; branch-and-price; introduction to optimization over lattices.
- UCL-TC02 **Tools for Supply Chain Management Decisions**. Louvain School of Management (LSM), **UCL**, Belgium. ETCS: 5. Theory: 30h; Level: Master. Language: English. Description: Convexity; Minkowski polyhedral representation; duality; from linear programming to convex programming; the revised simplex algorithm as a computational paradigm; complexity of algorithms; mixed integer programming; models and methods for cutting stock, bin packing, planning and scheduling problems.
- 2014-2017 UCL-TC07 **Quantitative Project and Project Management**. Louvain School of Management (LSM), **UCL**, Belgium. ETCS: 5. Theory: 15h; Exercises: 0h. Level: Master. Language: French. Description: The course focus on the resolution, via optimization techniques, of industrial problems involving, among others, transportation, location, planning, routing, and network design features. The introductory part of the course consists of a recall of mixed integer linear programming, including modeling with binary variables, logical conditions, simple implications, generalized implications, products of binary variables, dichotomies, counting, general integer, partial integers, semi-continuous variables, products of binary variables and real variables, fundamental theory of the real case studied, prototyping with Fico Xpress IVE, basics of Fico Xpress Mosel, advanced aspects of Fico Xpress Mosel.
- 2014-2015 ULB-TC01 **Algorithms 2 (INFO-F-203)**. Computer Science Department, **Université Libre de Bruxelles**, Belgium. ETCS: 5. Theory: 24h; Exercises: 24h. Level: Bachelor. Language: French. Description: The course provides an introduction to hash tables, binary search trees, red-black trees, graphs, search for strongly connected

components and cycles, topological sorting, minimum spanning trees, shortest path algorithms, general algorithms on graphs.

- 2013-2014      RUG-TC01 **Operations Research 2 (Foundation of Logistics System Engineering)**. Faculty of Economics and Business, **University of Groningen**, The Netherlands. ETCS: 5. Theory: 40h; Exercises: 40h. Level: Bachelor. Language: English. Description: The course deals with optimization aspects related to transportation, location, planning, routing, network optimization, and (introduction to) heuristics and integer programming.
- RUG-TC02 **Integer Programming & Combinatorial Optimization**. Faculty of Economics and Business, **University of Groningen**, The Netherlands. ETCS: 5. Theory: 40h; Exercises: 40h. Level: Master. Language: English. Description: The course covers all of the topics discussed in the book L. Wolsey. *Integer Programming*, Wiley Interscience, NY, 1998.
- RUG-TC03 **Capita Selecta EORAS (Advanced Linear and Integer Optimization)**. Faculty of Economics and Business, **University of Groningen**, The Netherlands. ETCS: 5. Theory: 40h; Exercises: 40h. Level: Master. Language: English. Description: The course deals with projective and decomposition approaches to large scale linear and integer programming, with special attention to Bender's decomposition and Dantzig-Wolfe decomposition.
- 2012-2013      RUG-TC04 **Supply Network Analysis**. Faculty of Economics and Business, **University of Groningen**, The Netherlands. ETCS: 5. Theory: 40h; Exercises: 40h. Level: Master. Language: English. Description: The course covers advanced aspects of combinatorial optimization and covers the following topics: Network Matrices, Total Unimodularity, Network Design; Polyhedral Combinatorics, Strengthening Valid Inequalities, Branch-and-Price.
- 2011-2012      ULB-TC02 **Algorithms 2 (INFO-F-203)**. Computer Science Department, **Université Libre de Bruxelles**, Belgium. ETCS: 5. Theory: 24h; Exercises: 24h. Level: Bachelor. Language: French. Description: The course provides an introduction to hash tables, binary search trees, red-black trees, graphs, search for strongly connected components and cycles, topological sorting, minimum spanning trees, shortest path algorithms, general algorithms on graphs.

Teaching activities (exercise sessions) during the post-doctoral activities:

- 2011-2013      ULB-EX01 **Combinatorial Optimization (INFO-F-424)**. Computer Science Department, **Université Libre de Bruxelles**, Belgium. ETCS: 5. Theory: 24h; Exercises: 12h. Level: Master. Language: French. Description: The course covers all of the topics discussed in the book L. Wolsey. *Integer Programming*, Wiley Interscience, NY, 1998.
- 2011-2012      ULB-EX02 **Continuous Optimization (INFO-F-524)**. Place: Computer Science Department, **Université Libre de Bruxelles**, Belgium. ETCS: 5. Theory: 24h; Exercises: 12h. Level: Bachelor. Language: French. Description: The course covers linear programming, constrained and unconstrained optimization, Lagrangian relaxation in combinatorial optimization; column generation methods, the interior point method.
- 2009-2011      ULB-EX03 **Foundations of Computer Science (INFO-F-206)**. Computer Science Department, **Université Libre de Bruxelles**, Belgium. ETCS: 10. Theory: 36h; Exercises: 48h; Final Project: 12h. Level: Bachelor. Language: French. Description: The course introduces to computer science and deals with the fundamental algorithms on arrays and lists, recursion, and sorting.

## Ph.D. Supervision, Co-Supervision, and Collaboration Activities

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Type	Name	Synopsis
Doctoral Students	Martin Frohn	<p>Graduate student from University of Köln, Germany, under the supervision of Michael Junger. Martin started his doctoral studies in 2017 under my supervision. His doctoral studies focus on the characterization of a particular class of network design problems having important practical applications in phylogenetics and evolution, information theory, and data compression and encryption. His PhD defense will hold during the academic year 2021. So far, Martin authored the following manuscripts:</p> <ul style="list-style-type: none"> <li>– D. Catanzaro, M. Frohn, O. Gascuel, and R. Pesenti. A Tutorial on the Balanced Minimum Evolution. <i>European Journal of Operational Research</i>, invited article, minor revision pending, 2021.</li> <li>– M. Frohn. On the approximability of the Fixed-Tree Balanced Minimum Evolution Problem. <i>Optimization Letters</i>, accepted, 2021.</li> <li>– D. Catanzaro, M. Frohn, and R. Pesenti. An information theory perspective on the Balanced Minimum Evolution Problem. <i>Operations Research Letters</i>, 48(3): 362-367, 2020.</li> </ul>
	Henri Dehaybe	<p>Graduate student from UCL, Belgium, under my supervision. Henri started his doctoral studies in 2018-2019 under the supervision of my colleague, Philippe Chevalier, and mine. His work focuses on optimization and reinforcement learning approaches for stochastic multilevel inventory management. The expected PhD defense is scheduled on 2024. So far, Henri authored the following manuscripts:</p> <ul style="list-style-type: none"> <li>– H. Dehaybe, D. Catanzaro, and P. Chevalier. A Deep Reinforcement Learning approach for the Stochastic Inventory Problem. <i>Operations Research</i>, 2021.</li> </ul>
	Roberto Ronco	<p>Roberto is carrying out his doctoral studies in Computer Science and Operations Research at the University of Genoa, Italy, under the supervision of Massimo Paolucci. Large part of his research efforts are currently focusing on scheduling problems. I have collaborated with Roberto in the context of the following article:</p> <ul style="list-style-type: none"> <li>– D. Catanzaro, R. Pesenti, R. Ronco. A new fast and accurate solution approach for the automatic scene detection problem. <i>Computers and Operations Research</i>, April 2021.</li> </ul>
	Luciano Porretta	<p>Graduate student from University of L'Aquila under my co-supervision (2010). Luciano carried out his doctoral studies at the Graphs and Mathematical Optimization Unit of the Computer Science Department of the Université Libre de Bruxelles, Belgium, under the supervision of my colleague Bernard Fortz. He was awarded the title of Doctor of Sciences in January 2018. I have intensely collaborated with Luciano on a large part of his doctoral studies, focused on models and methods in genome-wide association studies. Our collaboration gave rise to the following articles:</p> <ul style="list-style-type: none"> <li>– L. Porretta, D. Catanzaro, B. V. Halldórsson, and B. Fortz. A Branch&amp;Price Algorithm for the Minimum Cost Clique Cover Problem in Max-Point Tolerance Graphs. <i>4OR</i>, 17(1), 75-96, 2019.</li> <li>– D. Catanzaro, M. Labbé, and L. Porretta. A class representative model for pure parsimony haplotyping under uncertain data. <i>PLoS One</i> 6(3): e17937, 2011.</li> </ul>

I have been member of the following doctoral defense committees:

Belgium	BE01	Nikita Doikov. Title: <i>Development of Second-Order Methods for Convex Optimization Problems</i> . Institute of Information and Communication Technologies, Electronics and Applied Mathematics, Louvain School of Engineering, Université Catholique de Louvain, June 2016. Member of the Committee.
	BE02	José Miguel Pesada Perez. Title: <i>Express shipment service network design: Challenges, advances and robustness</i> Louvain School of Management, Université Catholique de Louvain. Private Defense: March 17 2020. Public Defense: June 17, 2020. Chairman.
	BE03	Luciano Porretta. Title: <i>Models and methods for genome-wide association studies</i> Graphs and Mathematical Optimization Unit, Computer Science Department, Université Libre de Bruxelles, January 2018. Member of the Committee.
	BE04	Cyrille Dejemeppe. Title: <i>Abstractions and algorithms for scheduling applications</i> . Institute of Information and Communication Technologies, Electronics and Applied Mathematics, Louvain School of Engineering, Université Catholique de Louvain, June 2016. Member of the Committee.
Italy	IT01	Veronica Dal Sasso. Title: <i>Branch-and-price approaches for pure-parsimony haplotyping</i> . Department of Mathematics, University of Padua, Italy, December 2016. Member of the Committee.

## Other supervision activities

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Type	Description
Master Students	<p>I have supervised the master theses of over 40 students from the Université Libre de Bruxelles (Belgium), the Université de Mons-Hainaut (Belgium), the Università degli studi dell'Aquila (Italy), the University of Padua (Italy), the University of Groningen (The Netherlands), the University of Palermo (Italy), the Polytechnic University of Catalunya (Spain), and the Université Catholique de Louvain (Belgium).</p> <p>One of them worth a particular mention, namely Lieke Kools. Her master thesis entitled “Minimizing energy waste in real energy network distribution” carried out at the Faculty of Economics and Business of the University of Groningen, The Netherlands, was selected as the best master thesis in economics and business for the academic year 2014. She is currently a Ph.D. candidate at University of Leiden, The Netherlands.</p>

## Spoken Languages

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Mother Tongue	Italian;
Fluent	English, French, Spanish;
Beginner	Dutch (Level A1.1 obtained at the Vrije Universiteit Brussel on 06/2010).