

Curriculum vitae

Andrea Manno

GENERAL INFORMATION

Full name	Andrea Manno
Place of Birth	Rome, Italy
Citizenship	Italian
E-mail	andreamanno85@gmail.com, andrea.manno@univaq.it, andrea.manno@iasi.cnr.it
Spoken Languages	Italian, English, French

EDUCATION

2011 – 2014 **Ph.D. in Operations Research**
Institute: Department of Computer, Control and Management Engineering Antonio Ruberti at Sapienza Università di Roma, Italy
Thesis: “Decomposition algorithms for learning systems”.
Supervisor: Prof. S. Lucidi.
Grade: Excellent.

2007 – 2010 **M.Sc. in Management Engineering**
Institute: Department of Computer, Control and Management Engineering Antonio Ruberti at Sapienza Università di Roma, Italy
Thesis: “Sviluppo di tecniche di ottimizzazione globale per problemi di traiettoria di veicoli spaziali”.
Supervisor: Prof. S. Lucidi.
Grade: 110/110 cum laude.

2004 – 2007 **B.Sc. in Management Engineering**
Institute: Department of Computer, Control and Management Engineering Antonio Ruberti at Sapienza Università di Roma, Italy
Thesis: “Pianificazione della rete postale J+3 con adattamento dell’algoritmo di Clarke and Wright”.
Supervisor: Prof. C. Mannino.
Grade: 106/110.

1999 – 2004 **Senior high school**
Institute: Liceo Scientifico Statale Augusto Righi, Rome, Italy
Grade: 100/100.

WORKING EXPERIENCES

08/2023 – today **Ricercatore a tempo determinato (B)**,
Academic discipline: MAT/09 (Operations Research)
Institute: University of L’Aquila, Center of Excellence DEWS,
Department of Information Engineering, Computer Science and Mathematics, Italy.

12/2022 – 07/2023 **Research fellow**
Research title: “Sviluppo di attività scientifica nelle aree di ottimizzazione per l’accessibilità
Academic discipline: MAT/09 (Operations Research)

e per il concetto di gemello digitale in ambito urbano ”.
Institute: CNR-IASI, Rome, Italy.

- 08/2019 – 07/2022 **Ricercatore a tempo determinato (A),
funding PON-AIM (Attraction and International Mobility)**
Academic discipline: MAT/09 (Operations Research)
Institute: University of L’Aquila, Center of Excellence DEWS,
Department of Information Engineering, Computer Science and Mathematics, Italy.
- 01/2016 – 07/2019 **Research fellow**
Research title: “Metodi di programmazione mista intera applicati a problemi energetici ”.
Academic discipline: MAT/09 (Operations Research)
Institute: Politecnico di Milano, Dipartimento di Elettronica, Informazione e Bioingegneria, Italy.
- 12/2014 – 11/2015 **Research fellow**
Research title: “Logistica dei farmaci per un reparto di terapia intensiva ”.
Academic discipline: MAT/09 (Operations Research)
Institute: Dipartimento di Ingegneria Informatica, University of Florence, Italy.
- 09/2011 – 10/2011 **Consultant**
Job description: Algorithm Engineer at ACTSolutions S.r.l., Rome, Italy.
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PARTECIPATION IN PROJECTS

- 12/2022 – today **CASA DELLE TECNOLOGIE EMERGENTI D MATERA**
Role: Investigator.
Description: development of scientific activities in the area of simulation-based optimization and Machine Learning in the context of the design of a digital twin for the Matera and Catania cities.
Type of funding: CUP I14E20000020001-Asse I, Casa delle Tecnologie Emergenti, Programma di Supporto Tecnologie Emergenti (FSC2014-2020) Piano degli Investimenti per la Diffusione della Banda Larga.
Funding amount: 100000€.
Institute: CNR-IASI, Rome, Italy.
- 08/2019 – 07/2022 **Algoritmi, Sistemi e Dispositivi per Monitoraggio e Diagnostica di Macchine per le Fabbriche Intelligenti (ASSIOMI)**
Role: Investigator.
Description: development of monitoring systems for numerical control machines faults based on Machine Learning and optimization techniques, in collaboration with Protek S.r.l.
Type of funding: Bando Fabbrica Intelligente (Project n. F/190003/01-03/X44) funded by University and Research Ministry (“ASSIOMI”, “PON R&I 20142020”) in the context of Industria 4.0.
Funding amount: 700000€.
Institute: University of L’Aquila, Center of Excellence DEWS.
- 02/2020 – 07/2020 **Neural Heating Network**

Role: Principal Investigator.

Description: development of a Python based Decision Support System (DSS) combining optimization and machine learning techniques for the 24 hours ahead forecast of the heating hourly energy consumption of the city of Brescia. The project was carried out in collaboration with Mathesia S.r.l., Politecnico di Milano and A2A S.p.A.. The DSS developed provides accurate predictions, and was adopted by the A2A company for forecast activity. The project led to the working paper [17] submitted for publication.

Type of funding: contratto di ricerca finanziato dal Politecnico di Milano.

Funding amount: 11000€.

Institute: University of L'Aquila.

01/2016 – 07/2019 **Predictable Flexible Molten Salts Solar Power Plant (PreFlexMS H2020)**

Role: Investigator.

Description: Development of an optimization algorithm for the start-up phase of an innovative Concentrated Solar Power plant. In this project a new derivative-free algorithm for locally optimize expensive black-box functions was devised. Both efficiency and effectiveness of the algorithm were assessed in a comparison with several state-of-the-art solvers. Then it was applied, with very promising results, in combination with a global search method to the start-up phase optimization of the Concentrated Solar Power Plant. The research material for the project led to an article published on an international scientific journal [8].

Type of funding: Horizon 2020.

Funding amount: 43000€.

Institute: Politecnico di Milano.

02/2017 – 02/2019 **Efficient Energy Systems for Smart Urban Districts (EffiCity)**

Role: Investigator.

Description: combining robust optimization and machine learning for efficient energy systems for smart urban districts. This project exploits a set of historical energy consumption and weather data of some buildings and city districts, coupled with a smart preprocessing technique, to train an Artificial Neural Network to accurately predict the hourly energy consumption of a hospital and a university campus. The methodology adopted and the results obtained were reported in an article published on an international scientific journal [10].

Type of funding: co-funded by Emilia Romagna region (fondi POR-FESR 2014-2020) and coordinated by LEAP (Laboratorio Energia Ambiente Piacenza).

Funding amount: 27000€.

Institute: Politecnico di Milano.

07/2017 – 06/2018 **NPLs OPTIMIZATION**

Role: Investigator.

Description: mixed-integer programming for portfolio optimization of non-performing loans (NPLs). In this project, specific mixed-integer models and algorithmic techniques were used for optimizing the NPLs portfolio of a major Italian bank. Those techniques were embedded in an optimization software, currently used by the bank. The project led to the working paper [18] to be submitted for publication .

Type of funding: research contract funded by Capital Light Bank, Intesa San Paolo.
Funding amount: 40000€.
Institute: Politecnico di Milano.

LIST OF SELECTED SCIENTIFIC PUBLICATIONS

- [1] L. Grippo, A. Manno, M. Sciandrone (2016). “Decomposition techniques for multilayer perceptron training”, *IEEE Transactions on Neural Networks and Learning Systems*, 27(11), pp. 21462159.
- [2] A. Manno, S. Sagratella, L. Livi (2016). “A convergent and fully distributable SVMs training algorithm”, *Proceedings of the International Joint Conference on Neural Networks*, 2016-October, pp. 30763080, 7727590.
- [3] A. Avenali, G. Catalano, T. D’Alfonso, G. Matteucci, A. Manno (2017). “Key-cost drivers selection in local public bus transport services through machine learning”, *WIT Transactions on the Built Environment*, 176, pp. 155166.
- [4] A. Manno, L. Palagi, S. Sagratella (2018). “Parallel decomposition methods for linearly constrained problems subject to simple bound with application to the SVMs training”, *Computational Optimization and Applications*, 71(1), pp. 115145.
- [5] Lampariello, L., Manno, A., Sagratella, S. (2019). “Improving social assistance service for minors and disabled people by using multiobjective programming”, *AIRO Springer Series*, 2, pp. 141150.
- [6] Manno, A., Palagi, L., Sagratella, S. (2019). “Case-Production and distribution optimization of beach equipment for the Marinero company”, *INFORMS Transactions on Education*, 19(3), pp. 155159.
- [7] Manno, A., Palagi, L., Sagratella, S. (2019). “Case article-Production and distribution optimization of beach equipment for the marinero company”, *INFORMS Transactions on Education*, 19(3), pp. 152154.
- [8] Manno, A., Amaldi, E., Casella, F, Martelli, E. (2020). “A local search method for costly black-box problems and its application to CSP plant start-up optimization refinement”, *Optimization and Engineering*, 21(4), pp. 15631598.
- [9] Chelazzi, C., Villa, G., Manno, A., Ranfagni, V., Gemmi, E., Romagnoli, S. (2021). “The new SUMPOT to predict postoperative complications using an Artificial Neural Network”, *Scientific Reports*, 11(1), 1-12.
- [10] Manno, A., Martelli, E., Amaldi, E. (2022). “A Shallow Neural Network Approach for the Short-Term Forecast of Hourly Energy Consumption”, *Energies*, 15(3), 958.

- [11] Manno, A., Rossi, F., Smriglio, S, Cerone, L. (2022). “Comparing deep and shallow neural networks in forecasting call center arrivals ”, *Soft Computing*.
- [12] Zaryab, S. A., Manno, A., Martelli, E. (2022). “SCR: A novel surrogate-based global optimization algorithm for constrained black-box problems. ”, *Computer Aided Chemical Engineering*, Vol. 51, pp. 1213-1218. Elsevier.
- [13] E. Amaldi, A. Consolo, A. Manno. “On multivariate randomized classification trees: l_0 -based sparsity, VC-dimension and decomposition methods”, *Computers & Operations Research*, 151, 106058.
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OTHER SCIENTIFIC PUBLICATIONS

- [14] L. Diana, A. Manno, P. Lestuzzi, S. Podestà, C. Luchini (2018). “Impact of displacement demand reliability for seismic vulnerability assessment at an urban scale”, *Soil Dynamics and Earthquake Engineering*, 2018, 112, pp. 3552.
- [15] Diana, L., Manno, A., Lestuzzi, P. (2019). “Seismic displacement demand prediction in non-linear domain: Optimization of the N2 method ”, *Earthquake Engineering and Engineering Vibration*, 2019, 18(1), pp. 141158.
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WORKING PAPERS

- [16] E. Amaldi, A. Consolo, A. Manno. “A decomposition method for building randomized regression trees”.
- [17] A. Manno, O. Jabali, F. Malucelli. “An optimized weighted sum of Artificial Neural Networks models to accurately predict the 24 hours ahead energy demand of a city”.
- [18] E. Amaldi, A. Manno. “A MILP approach for optimizing non-performing loans portfolios based on the Loss Given Default”.
- [19] A. Manno, V. Zelli, E. Alesse, F. Rossi, C. Arbib, A. Tessitore. “Analysis of molecular TCGA data by using feature extraction and machine learning approaches aimed at distinguishing tumor types. ”.
- [20] A. Amicosante, A. Avenali, T. D’Alfonso, M. Giagnorio, A. Manno, G. Matteucci. “Predicting costs of local public bus transport services through machine learning methods ”.
- [21] A. Consolo, A. Manno. “Kernel Logistic Regression: an optimization methodology to induce sparsity.”.
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MAIN RESEARCH INTERESTS

Keywords: My research activity mainly concerns the use of nonlinear optimization

<i>Nonlinear optimization</i>	<p>techniques to develop new models and training algorithms for Machine Learning architectures (e.g., Neural Networks, Support Vector Machines, Decision Trees). A special focus is given to sequential and parallel decomposition methods to handle big-data instances, and to regularization strategies to generate more general and interpretable models. The research deals with both theoretical issues (e.g., asymptotic convergence of training algorithms, VC dimension of Machine Learning models) and methodological aspects. Further related research concerns the application of Machine Learning models and algorithms in energy, healthcare, transportation, and industrial contexts.</p>
<i>Decomposition algorithms</i>	
<i>Machine Learning</i>	
<i>Neural Networks</i>	
<i>Support Vector Machines</i>	
<i>Randomized Decision Trees</i>	<p>Another research topic is related to the design of new derivative-free local and global algorithms for costly black-box functions. This research activity is stimulated by innovative energy/industrial case-studies.</p>
<i>Sparsity</i>	
<i>Derivative-free optimization</i>	
<i>Costly black-box optimization</i>	

INVITED SEMINARS

- 26 Mag. 2023 Title: "Machine Learning: il punto di vista dell'ottimizzazione" (2 hours).
Institute: Università degli Studi del Sannio di Benevento.
- 20 Dec. 2022 Title: "Supervised and Unsupervised Machine Learning" (2 hours).
Institute: Università degli Studi del Sannio di Benevento.

TEACHING

- 2021/2022 **professor**
University of L'Aquila,
Department of Information Engineering, Computer Science and Mathematics, Italy.
Title: "Nonlinear Optimization for Machine Learning Architectures" (in English), 2CFU.
Level: PhD programme in Information and Communication Technology.
- 2021 **professor and member of the organizing committee**
University of Zilina, Slovakia.
Titles (3 modules, 12 hours):
1) "Introduction to Optimization"
2) "Autodiff and Artificial Neural Networks"
3) "Support Vector Machines"
Level: international Machine Learning Summer School.
- 2022/2023 **professor**
2021/2022 University of L'Aquila,
2020/2021 Department of Information Engineering, Computer Science and Mathematics, Italy.
Title: "Data Driven Decision" (in English), 3 CFU.
Level: M.Sc. in Computer Science, Mathematical Engineering, Erasmus Mundus programme MathMods, Erasmus Mundus programme InterMaths.

- 2021/2022 **professor**
 2020/2021 University of L'Aquila,
 2019/2020 Department of Information Engineering, Computer Science and Mathematics, Italy.
 Title: "Introduzione alla Data Science" (in Italian), 4 CFU.
 Level: first level Master in Mobile and Web Technologies.
- 2021/2022 **professor**
 2019/2020 University of L'Aquila,
 Department of Information Engineering, Computer Science and Mathematics, Italy.
 Title: "Precorso di Matematica" (in Italian), 28 hours.
 Level: B.Sc. in Computer Science, Information Engineering, Mathematics, Physics.
- 2017/2018 **Adjunct professor**
 Politecnico di Milano, Dipartimento di Elettronica, Informazione e Bioingegneria, Italy.
 Title: "Metodi di Ottimizzazione della Ricerca Operativa" (in Italian), 5 CFU.
 Level: B.Sc. in Management Engineering.
- 2015/2016 **Adjunct professor**
 2014/2015 Department of Computer, Control and Management Engineering Antonio Ruberti,
 Sapienza Università di Roma, Italy.
 Title: "Algoritmi di Ottimizzazione" (in Italian), 3 CFU.
 Level: M.Sc. in Management Engineering and Ph.D..
- 2014/2015 **Adjunct professor**
 Department of Computer, Control and Management Engineering Antonio Ruberti,
 Sapienza Università di Roma, Italy.
 Title "Laboratorio di Ricerca Operativa" (in Italian), 3 CFU.
 Level: B.Sc. in Management Engineering.
- 2018/2019 **Teaching assistant**
 2017/2018 Politecnico di Milano, Dipartimento di Elettronica, Informazione e Bioingegneria, Italy.
 2016/2017 Title: "Optimization" (in English).
 2015/2016 Level: M.Sc. in Mathematical Engineering and Ph.D..
- 2018/2019 **Teaching Assistant**
 2016/2017 Politecnico di Milano, Dipartimento di Elettronica, Informazione e Bioingegneria, Italy.
 Title: "Foundations of Operations Research" (in English).
 Level: M.Sc. in Computer Engineering and Ph.D..
- 2018/2019 **Teaching Assistant**
 2016/2017 Politecnico di Milano, Dipartimento di Elettronica, Informazione e Bioingegneria, Italy.
 Title: "Metodi di Ottimizzazione della Ricerca Operativa" (in Italian).
 Level: B.Sc. in Management Engineering.

2013/2014 **Teaching assistant**

Department of Computer, Control and Management Engineering Antonio Ruberti
Sapienza Università di Roma, Italy.

Title: "Ottimizzazione dei Sistemi Complessi" (in Italian).

Level: M.Sc. in Management Engineering.

THESIS SUPERVISION

- a.y. 2022/2023 Title: Tecniche di realizzazione di un dataset per la clusterizzazione di pazienti critici sottoposti a trattamenti extracorporei nei reparti di terapia intensiva.
Level: Master degree.
Programme: Computer Science.
Institute: University of L'Aquila.
Role: Co-relatore.
- a.y. 2021/2022 Title: Models for Italian Energy Price (PUN) Prediction.
Level: Master degree.
Programme: Mathematical Engineering.
Institute: University of L'Aquila.
Role: Co-relatore.
- a.y. 2021/2022 Title: Predicting the costs of public transport services using machine learning methods.
Level: Master degree.
Programme: Informatica.
Institute: University of L'Aquila.
Role: Relatore.
- a.y. 2020/2021 Title: Statistical predictive models for call center forecast.
Level: Master degree.
Programme: InterMaths Applied and Interdisciplinary Mathematics.
Institution: University of L'Aquila.
Role: Supervisor.
- a.y. 2020/2021 Title: Ad-hoc preprocessing and Machine Learning techniques to distinguish cancer types.
Level: Master degree.
Programme: Mathematical Modelling in Engineering.
Institution: University of L'Aquila.
Role: Supervisor.
- a.y. 2019/2020 Title: Comparison between different neural network approaches for incoming call volume forecasting.
Level: Master degree.
Programme: Computer Science.
Institution: University of L'Aquila.

	Role:	Co-supervisor.
a.y. 2018/2019	Title:	Enhanced and extended version of rqlif method for derivative-free optimization with costly objective function.
	Level:	Master degree.
	Programme:	Computer Science and Engineering.
	Institution:	Politecnico di Milano.
Istituto	Role:	Supervisor.
a.y. 2018/2019	Title:	Improvements and extensions of sparse optimal randomized classification trees.
	Level:	Master degree.
	Programme:	Mathematical Engineering.
	Institution:	Politecnico di Milano.
	Role:	Co-supervisor.
a.y. 2018/2019	Title:	An ℓ_0 -norm sparsification approach for multilayer perceptron training.
	Level:	Master degree.
	Programme:	Mathematical Engineering.
	Institution:	Politecnico di Milano.
	Role:	Co-supervisor.

SCIENTIFIC AWARDS AND ACKNOWLEDGMENTS

- 2023 Italian National Scientific Habilitation for the role of associate professor for the academic recruiter field 01/A6 (Operations Research) with validity 23/05/2023-23/05/2034
- 2016 Premio Airo: Ricerca Operativa per il sociale
46th Annual Conference of the Italian Operational Research Society
“La programmazione multi-obiettivo al servizio del benessere sociale”.
- 2015 Ranked 3th at the 8th edition of the Global Trajectories Optimization Competition
“Very-Long-Baseline Interferometry”.

CONFERENCES ATTENDANCE

- 04–07 Sep. 2023 Optimization and Decision Science International Conference (ODS2023)
Ischia, Italy.
Title: “Binary Kernel Logistic Regression: sparsity and a SMO-type decomposition algorithm”.
Role: Speaker.
- 29–30 Jul. 2022 19th EUROPT Workshop on Advances in Continuous Optimization
Lisbon, Portugal.

- Title: “On multivariate randomized classification trees training”.
 Role: Speaker.
- 19 Nov. 2020 Optimization and Decision Science International Conference (ODS2020)
 Online.
 Title: “Forecasting call center arrivals by deep and shallow neural networks”.
 Role: Speaker.
- 4–7 Sept. 2017 Optimization and Decision Science International Conference (ODS2017)
 Sorrento, Italy.
 Title: “A derivative-free local search algorithm for costly optimization problems with black-box functions”.
 Role: Speaker.
- 13–16 Sept. 2016 Società Italiana di Matematica Applicata e Industriale (SIMAI) 2016
 Milan, Italy.
 Title: “Numerical optimization of the start-up phase of a Concentrated Solar Power plant”.
 Role: Speaker.
- 6–9 Sept. 2016 46th Annual Conference of the Italian Operational Research Society
 Trieste, Italy.
 Title: “A convergent and fully distributable SVMs training algorithm”.
 Role: Speaker.
- 7–10 Sept. 2015 45th Annual Conference of the Italian Operational Research Society
 Pisa, Italy.
 Title: “Pharmaceuticals optimization for ICUs”.
 Role: Speaker.
- 08–10 July 2015 13th EUROPT Workshop on Advances in Continuous Optimization
 Edinburgh, Scotland.
 Title: “Decomposition techniques for multilayer perceptron training”.
 Role: Speaker.
- 01–04 July 2013 26th European Conference on Operational Research (EURO)
 Rome, Italy.
 Role: Audience.
- 26–28 June 2013 11th EUROPT Workshop on Advances in Continuous Optimization
 Florence, Italy.
 Role: Audience.
- 10–17 June 2013 59th Workshop on Nonlinear Optimization: a Bridge from Theory to Applications
 Erice, Italy.
 Title: “A new algorithm for the solution of large-scale singly linearly
 constrained problems subject to simple bounds”.

Role: Speaker.

04–07 Sept. 2012 43th Annual Conference of the Italian Operational Research Society
Vietri sul Mare, Italy.

Title: “A truncated Newton method for singly linearly-constrained problem subject to simple bounds”.

Role: Speaker.

SCHOOLS ATTENDANCE

25–28 June 2019 MINOA Summer School: Mixed-Integer Nonlinear Optimization meets Data Science,
Ischia, Italy.

23–28 June 2014 CIME-EMS Summer School in applied mathematics on Centralized and Distributed
Multi-agent Optimization: Models and Algorithms, Cetraro, Italy.

03–08 Dec. 2012 Scientific Computing using C++ Language at CASPUR, Rome, Italy.

EDITORIAL ACTIVITIES

July 2021–today

Journal: Soft Computing.

Role: Associate Editor.

SCIENTIFIC RESPONSIBILITIES

Aug.2023–today Research Associate at Istituto di Analisi dei Sistemi ed Informatica ”Antonio Ruberti”,
Consiglio Nazionale delle Ricerche, Italy.

Mar.2022–today Scientific coordinator of a framework agreement between University of L’Aquila
and Atlante S.r.l., concerning a mutual collaboration for research and development, study and
education on innovative projects in the energy and transportation fields. The cooperation
primarily focuses on Optimization, Data Analytics, Artificial Intelligence and Machine Learning.

Aug.2019–today Affiliated with the Center of Excellence DEWS, University of L’Aquila.

COMPUTER SKILLS

Programming languages:	C++, Java, Fortran, Matlab, Python.
Word processors:	Latex, MS Office, Openoffice.
Numerical computing environments:	Matlab, R, Python.
Optimization tools:	AMPL, CPLEX, Gurobi, Baron, SNOPT, Cbc.
Simulation tools:	Arena, Simio.
Medical software:	PROSAFE.
