Alberto Maria Metelli

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Short Bio

Alberto Maria Metelli obtained the Ph.D. in Information Technology in March 2021 at Politecnico di Milano, defending the dissertation "Exploiting Environment Configurability in Reinforcement Learning", under the supervision of Prof. Marcello Restelli. He is currently a Postdoctoral research assistant at Politecnico di Milano. His main research interests revolve around *artificial intelligence* and *machine learning*, in particular *reinforcement learning*. He is currently working on reinforcement learning in *configurable environments*, *off-policy* reinforcement learning, and the applications to *autonomous driving*. He is also interested in algorithms, optimization, and recommender systems.

Academic Experience

Mar 2021–present	**Postdoctoral Research Assistant**, *Politecnico di Milano, Dipartimento di Elettronica, Informazione e Bioingegneria*, Milan, Italy. *Research title*: "Development of reinforcement learning algorithms for autonomous driving applications" *Project leader*: Prof. Marcello Restelli

Professional Experience

Nov 2020–present	**Co-founder and AI specialist**, *ML Cube S.r.l.*, Milano (Mi), Italy.
Mar 2012–Jun 2012	**Freelance developer**. Design and implementation of a database system to manage organization and scheduling of remedial courses (corsi di recupero) for IISS Ettore Majorana, Seriate.
Jun 2011–Jul 2011 Jan 2012–Feb 2012	**Internship**, *Poligrafica s.r.l.*, Dalmine (Bg), Italy. Design and implementation of a mobile application (Android) for composing and printing flyers.

Education

Nov 2017–Mar 2021	**Ph.D. in Information Technology**, *Politecnico di Milano, Dipartimento di Elettronica, Informazione e Bioingegneria*, Milan, Italy. *Ph.D. Dissertation*: "Exploiting Environment Configurability in Reinforcement Learning" *Supervisor*: Prof. Marcello Restelli *Final Mark*: Laude
Oct 2015–Jul 2017	**M.Sc. in Computer Science and Engineering**, *Politecnico di Milano*, Milan, Italy. *Master's thesis*: "Compatible Reward Inverse Reinforcement Learning" *Supervisor*: Prof. Marcello Restelli, *Co-supervisor*: Matteo Pirotta, Ph.D. *Final Mark*: 110/110 cum Laude
Sep 2012–Jul 2015	**B.Sc. in Computer Science and Engineering**, *Politecnico di Milano*, Milan, Italy. *Final Mark*: 110/110 cum Laude
Sep 2007–Jul 2012	**High School Diploma**, *IISS Ettore Majorana*, Seriate (Bg), Italy. Specialization in Computer Science (Perito Informatico) *Final Mark*: 100/100 cum Laude

Awards

Sep 2020	ICML 2020 top 33% highest-scoring reviewers
Sep 2019	NeurIPS 2019 top 50% highest-scoring reviewers
Oct 2018	Winner of Premio NeoLaureati *Leonardo Lesmo* 2018 (AIxIA) for the best Italian Master Thesis in Artificial Intelligence.
Jul 2017	Winner of a Ph.D. scholarship granted by the Italian Ministry of Education, University and Research (ranked first among applicants of Politecnico di Milano in Computer Science and Engineering area).
Jun 2017	Second place at *ACM RecSys Challenge 2017* (with a team of 8 students from Politecnico di Milano).
May 2014	Winner of *Le migliori matricole dell'A.A. 2012/2013* (best freshman students) award from Politecnico di Milano.
2012	Enrollment to the *Albo Nazionale delle Eccellenze* (National Register of Excellences) among best high-school graduates.
Jun 2012	Winner of *Migliori Elaborati 2012* (Best Project 2012) award from IISS Ettore Majorana, Seriate (high-school), for the developing of a database system to manage remedial courses (corsi di recupero).
Oct 2011	Bronze medal at *Olimpiadi Italiane di Informatica 2011* (Italian Olympiad in Informatics), AICA Associazione Italiana per l'Informatica ed il Calcolo Automatico.

Languages

Italian	**Mother tongue**
English	**Excellent**
Jun 2012	FCE (First Certificate in English), University of Cambridge

IT Certifications

Jun 2012	EUCIP IT Administrator Fundamentals, AICA.
May 2012	EUCIP IT Administrator, AICA, *Modules: PC Hardware, Operating System, LAN and Network Services, Network Expert Use, IT Security.*
May 2012	CCNA Discovery Networking for Home and Small Businesses, Cisco Networking Academy.
Feb 2011	IT Essentials: PC Hardware and Software, Cisco Networking Academy.
Nov 2009	ECDL, AICA.

Teaching Activity

2018–2020	**Teaching Assistant**, B.Sc. course Informatica (Computer Science), for the Environmental and Land Planning Engineering degree, Scuola di Ingegneria Civile, Ambientale e Territoriale, Politecnico di Milano - Campus Leonardo. Prof: Andrea Bonarini.
2018–2020	**Laboratory Teaching Assistant**, B.Sc. course Informatica (Computer Science), for the Environmental and Land Planning Engineering degree, Scuola di Ingegneria Civile, Ambientale e Territoriale, Politecnico di Milano - Campus Leonardo. Prof: Andrea Bonarini.
2017–2018	**Laboratory Teaching Assistant**, B.Sc. course Informatica A (Computer Science A), for the Management Engineering degree, Scuola di Ingegneria Industriale e dell'Informazione, Politecnico di Milano - Campus Bovisa. Prof: Florian Daniel.

Student Supervision

Master's Thesis Co-supervision and Tutoring

○ Mirco Mutti, "Configurable Markov Decision Processes". Co-supervision. Supervisor: Prof. Marcello Restelli (M.Sc. in Computer Science and Engineering, April 2018). Winner of Premio NeoLaureati *Leonardo Lesmo* 2019 (AIxIA) for the best Italian Master Thesis in Artificial Intelligence.

○ Luca Villa, "Autonomous vehicle control through machine learning algorithms". Tutoring. (M.Sc. in Mechanical Engineering, April 2018)

○ Borja González León, "Design of a Deep Inverse Reinforcement Learning Algorithm for Autonomous Vehicles".

Tutoring. (M.Sc. in Telecommunication Engineering, Universidad Politécnica de Madrid, 2018)

○ Amarildo Likmeta, "Driving Exploration Through Particle Q-Distributions". Co-supervision. Supervisor: Prof. Marcello Restelli (M.Sc. in Computer Science and Engineering, October 2018)

○ Emanuele Ghelfi, "Reinforcement Learning in Configurable Environments: an Information Theoretic approach". Co-supervision. Supervisor: Prof. Marcello Restelli (M.Sc. in Computer Science and Engineering, December 2018)

○ Francesco Faccio, "Study of Importance Sampling Techniques for Policy Optimization". Co-supervision. Supervisor: Prof. Marcello Restelli (M.Sc. in Mathematical Engineering, December 2018)

○ Lorenzo Lupo, "Exploration in Policy Search via Multiple Importance Sampling". Co-supervision. Supervisor: Prof. Marcello Restelli (M.Sc. in Management Engineering, April 2019)

○ Riccardo Giol, "Reinforcement Learning for High-level Decision Making in Autonomous Driving". Co-supervision. Supervisor: Prof. Marcello Restelli (M.Sc. in Computer Science and Engineering, April 2019)

○ Giuseppe Mascellaro, "Modeling Uncertainty in Gradient Inverse Reinforcement Learning with Application to Autonomous Driving". Co-supervision. Supervisor: Prof. Marcello Restelli (M.Sc. in Computer Science and Engineering, July 2019)

○ Pierluca DOro, "Beyond Maximum Likelihood Model Estimation in Model-based Policy Search". Co-supervision. Supervisor: Prof. Marcello Restelli (M.Sc. in Computer Science and Engineering, October 2019, Honours Programme Scientific Research in Information Technology 2018-I)

○ Guglielmo Manneschi, "Exploiting Environment Configuration for Policy Space Identification". Co-supervision. Supervisor: Prof. Marcello Restelli (M.Sc. in Computer Science and Engineering, October 2019, Honours Programme Scientific Research in Information Technology 2018-II)

○ Guido Dino Ballabio, "Cutting Back on MDP's Features. A Theoretically Grounded Approach to Feature Selection in Reinforcement Learning". Co-supervision. Supervisor: Prof. Marcello Restelli (M.Sc. in Computer Science and Engineering, December 2019)

○ Flavio Mazzolini, "Action Persistence, a Way to Deal with Control Frequency in Batch Reinforcement Learning". Co-supervision. Supervisor: Prof. Marcello Restelli (M.Sc. in Computer Science and Engineering, April 2020)

○ Giovanni Lucente, "Reinforcement Learning for Autonomous Driving: Comfort and Robustness to Noise" Co-supervision. Supervisor: Prof. Marcello Restelli (M.Sc. in Mechanical Engineering, April 2020)

○ Andrea Mecchia, "Batch Reinforcement Learning for Highway Driving" Co-supervision. Supervisor: Prof. Marcello Restelli (M.Sc. in Computer Science and Engineering, June 2020)

○ Umberto Fazio, Luca Fucci, "Improving RL algorithms by human demonstrations for autonomous race driving" Tutoring. (M.Sc. in Computer Science and Engineering, June 2020)

○ Claudio Paterniti Isabella, "Learning from Expert Demonstrations on F1 Simulators, with Transfer Learning across Different Vehicle Setups" Tutoring. (M.Sc. in Computer Science and Engineering, July 2020)

○ Pietro Menchetti, "Partial Observability in Autonomous Driving" Co-supervision. Supervisor: Prof. Marcello Restelli (M.Sc. in Computer Science and Engineering, October 2020)

Project Tutoring

○ Tutoring of "Progetto di Ingegneria Informatica", Nicolò Brunello, "Reinforcement Learning on Racing Car Simulator", 2017. (B.Sc. in Computer Science and Engineering)

○ Tutoring of progetto Master CEFRIEL su AI&ML "Analisi di business intelligence e analytics con applicazione di algoritmi di classificazione e clustering basati su KPI aziendali", Martina Scaccini, 2020.

Talks and Seminars

Nov 2017	Seminar on "Distributional Reinforcement Learning", Politecnico di Milano, Milan, Italy.
Jul 2018	Long talk on "Configurable Markov Decision Processes", ICML 2018, Stockholmsmässan, Stockholm, Sweden.
Nov 2018	Talk on "Compatible Reward Inverse Reinforcement Learning", AIxIA 2018, Trento, Italy.
Jun 2019	Short talk on "Reinforcement Learning in Configurable Continuous Environments", ICML 2019, Long Beach Convention Center, Long Beach.
Jul 2020	Talk on "Control Frequency Adaptation via Action Persistence in Batch Reinforcement Learning ", ICML 2020, Online.
Jan 2021	Talk "From MAB to RL ... and beyond!", Meetup ML Modena, Online.
Feb 2021	Talk on "Policy Optimization as Online Learning with Mediator Feedback", AAAI 2021, Online.

Editorial Activities

Reviewer/Program Committee Member for International Conferences

- International Joint Conference on Artificial Intelligence (IJCAI): 2018 review assistant (1 paper), 2020 PC (4 papers), 2021 SPC (4 papers)

- Neural Information Processing Systems (NeurIPS): 2019 reviewer (5 papers), 2020 reviewer (6 papers)

- International Conference on Machine Learning (ICML): 2019 reviewer (2 papers), 2020 reviewer (6 papers), 2021 reviewer (7 papers)

- AAAI Conference on Artificial Intelligence (AAAI): 2020 PC (5 papers), 2021 (5 papers)

- International Conference on Artificial Intelligence and Statistics (AISTATS): 2020 reviewer (6 papers), 2021 (5 papers)

- European Conference on Artificial Intelligence (ECAI): 2020 review assistant (1 paper)

- European Conference on Machine Learning and Principles and Practice of Knowledge Discovery in Databases (ECML-PKDD): 2020 PC (6 papers)

- International Conference on Learning Representations (ICLR): 2021 (3 papers)

Reviewer for International Journals

- IEEE Transactions on Cognitive and Developmental Systems (TCDS): 2018 (1 paper)

- Journal of Artificial Intelligence Research (JAIR): 2019 (2 papers)

- Machine Learning Journal Springer (ML): 2019 (1 paper)

Industrial Projects

Jan 2018–Mar 2020	**Reinforcement Learning for Decision Making**, *Magneti Marelli*. Topic: Development a high-level decision-making policy for safely and effectively driving an autonomous car in particular situations where the vehicle has to interact with other vehicles. Role: Research scientist. Project Leader: Prof. Marcello Restelli.
Oct 2019–present	**Reinforcement Learning Techniques for Developing Artificial Test Drivers on a F1 Simulator**, *Ferrari*. Topic: Development of an autonomous F1 driver using reinforcement learning techniques to test new prototypes on the simulator and possibly suggests new behaviors to the drivers. Role: Research scientist. Project Leader: Prof. Marcello Restelli.

Schools

Oct 2017	ACAI Summer School on Reinforcement Learning, Nieuwpoort, Belgium.
Aug–Sep 2020	Theory of Reinforcement Learning Boot Camp, Online.
Sep 2020	Summer School on Machine Learning and Big Data with Quantum Computing (SMBQ 2020), Online.

Publications

International Journals

[J1] Amarildo Likmeta, Alberto Maria Metelli, Giorgia Ramponi, Andrea Tirinzoni, Matteo Giuliani, and Marcello Restelli. Dealing with multiple experts and non-stationarity in inverse reinforcement learning: an application to real-life problems. *Machine Learning*, Mar 2021.

[J2] Alberto Maria Metelli, Matteo Papini, Nico Montali, and Marcello Restelli. Importance sampling techniques for policy optimization. *Journal of Machine Learning Research*, 21(141):1–75, 2020.

[J3] Amarildo Likmeta, Alberto Maria Metelli, Andrea Tirinzoni, Riccardo Giol, Marcello Restelli, and Danilo Romano. Combining reinforcement learning with rule-based controllers for transparent and general decision-making in autonomous driving. *Robotics and Autonomous Systems*, 131:103568, 2020.

[J4] Alberto Maria Metelli, Matteo Pirotta, and Marcello Restelli. On the use of the policy gradient and hessian in inverse reinforcement learning. *Intelligenza Artificiale*, 14(1):117–150, 2020.

International Conferences

[C1] Alberto Maria Metelli, Matteo Papini, Pierluca D'Oro, and Marcello Restelli. Policy optimization as online learning with mediator feedback. In *The Thirty-Fifth AAAI Conference on Artificial Intelligence, AAAI 2021, Online*. AAAI Press, 2021. **Acceptance rate: 1692/7911 (21.4%)**, (*To appear*).

[C2] Alberto Maria Metelli, Flavio Mazzolini, Lorenzo Bisi, Luca Sabbioni, and Marcello Restelli. Control frequency adaptation via action persistence in batch reinforcement learning. In *Proceedings of the 37th International Conference on Machine Learning, ICML 2020, 13-18 July 2020, Virtual Event*, volume 119 of *Proceedings of Machine Learning Research*, pages 6862–6873. PMLR, 2020. **Acceptance rate: 1088/4990 (21.8%)**.

[C3] Giorgia Ramponi, Amarildo Likmeta, Alberto Maria Metelli, Andrea Tirinzoni, and Marcello Restelli. Truly batch model-free inverse reinforcement learning about multiple intentions. In Silvia Chiappa and Roberto Calandra, editors, *Proceedings of the Twenty Third International Conference on Artificial Intelligence and Statistics*, volume 108 of *Proceedings of Machine Learning Research*, pages 2359–2369, Online, 2020. PMLR.

[C4] Pierluca D'Oro, Alberto Maria Metelli, Andrea Tirinzoni, Matteo Papini, and Marcello Restelli. Gradient-aware model-based policy search. In *The Thirty-Fourth AAAI Conference on Artificial Intelligence, AAAI 2020, New York, NY, USA, February 7-12, 2020*, pages 3801–3808. AAAI Press, 2020. **Acceptance rate: 1591/7737 (20.6%)**.

[C5] Alberto Maria Metelli, Amarildo Likmeta, and Marcello Restelli. Propagating uncertainty in reinforcement learning via wasserstein barycenters. In *Advances in Neural Information Processing Systems 32: Annual Conference on Neural Information Processing Systems 2019, NeurIPS 2019, 9-14 December 2019, Vancouver, Canada.*, 2019. **Acceptance rate: 428/6743 (21.2%)**.

[C6] Mario Beraha, Alberto Maria Metelli, Matteo Papini, Andrea Tirinzoni, and Marcello Restelli. Feature selection via mutual information: New theoretical insights. In *International Joint Conference on Neural Networks, IJCNN 2019 Budapest, Hungary, July 14-19, 2019*, pages 1–9. IEEE, 2019.

[C7] Alberto Maria Metelli, Emanuele Ghelfi, and Marcello Restelli. Reinforcement learning in configurable continuous environments. In Kamalika Chaudhuri and Ruslan Salakhutdinov, editors, *Proceedings of the 36th International Conference on Machine Learning, ICML 2019, 9-15 June 2019, Long Beach, California, USA*, volume 97 of *Proceedings of Machine Learning Research*, pages 4546–4555. PMLR, 2019. **Acceptance rate: 773/3424 (22.6%)**.

[C8] Matteo Papini, Alberto Maria Metelli, Lorenzo Lupo, and Marcello Restelli. Optimistic policy optimization via multiple importance sampling. In Kamalika Chaudhuri and Ruslan Salakhutdinov, editors, *Proceedings of the 36th International Conference on Machine Learning, ICML 2019, 9-15 June 2019, Long Beach, California, USA*, volume 97 of *Proceedings of Machine Learning Research*, pages 4989–4999. PMLR, 2019. **Acceptance rate: 773/3424 (22.6%)**.

[C9] Alberto Maria Metelli, Mirco Mutti, and Marcello Restelli. Configurable markov decision processes. In Jennifer G. Dy and Andreas Krause, editors, *Proceedings of the 35th International Conference on Machine Learning, ICML 2018, Stockholmsmässan, Stockholm, Sweden, July 10-15, 2018*, volume 80 of *Proceedings of Machine Learning Research*, pages 3488–3497. PMLR, 2018. **Acceptance rate: 618/2473 (25.0%)**.

[C10] Alberto Maria Metelli, Matteo Papini, Francesco Faccio, and Marcello Restelli. Policy optimization via importance sampling. In Samy Bengio, Hanna M. Wallach, Hugo Larochelle, Kristen Grauman, Nicolò Cesa-Bianchi, and Roman Garnett, editors, *Advances in Neural Information Processing Systems 31: Annual Conference on Neural Information Processing Systems 2018, NeurIPS 2018, 3-8 December 2018, Montréal, Canada.*, pages 5447–5459, 2018. **Acceptance rate: 1011/4856 (20.8%), Oral: 30/4856 (0.62%)**.

[C11] Alberto Maria Metelli, Matteo Pirotta, and Marcello Restelli. Compatible reward inverse reinforcement learning. In Isabelle Guyon, Ulrike von Luxburg, Samy Bengio, Hanna M. Wallach, Rob Fergus, S. V. N. Vishwanathan, and Roman Garnett, editors, *Advances in Neural Information Processing Systems 30: Annual Conference on Neural Information Processing Systems 2017, 4-9 December 2017, Long Beach, CA, USA*, pages 2047–2056, 2017. **Acceptance rate: 678/3240 (20.9%)**.

International Workshops

[W1] Mattia Bianchi, Federico Cesaro, Filippo Ciceri, Mattia Dagrada, Alberto Gasparin, Daniele Grattarola, Ilyas Inajjar, Alberto Maria Metelli, and Leonardo Cella. Content-based approaches for cold-start job recommendations. In *Proceedings of the Recommender Systems Challenge 2017*, RecSys Challenge '17, pages 6:1–6:5, New York, NY, USA, 2017. ACM.

[W2] Alberto Maria Metelli, Mirco Mutti, and Marcello Restelli. Configurable markov decision processes. *European Workshop on Reinforcement Learning 14 (EWRL 14)*, 2018.

[W3] Pierluca D'Oro, Alberto Maria Metelli, Andrea Tirinzoni, Matteo Papini, and Marcello Restelli. Gradient-aware model-based policy search. *Workshop on Meta-Learning (MetaLearn 2019) @NeurIPS 2019*, 2019.

[W4] Amarildo Likmeta, Alberto Maria Metelli, Andrea Tirinzoni, Riccardo Giol, Marcello Restelli, Danilo Romano, and Andrea Alessandretti. Autonomous driving with reinforcement learning and rule-based policies. *Workshop on AI for Autonomous Driving (AIAD) @ICML 2020*, 2020.

[W5] Amarildo Likmeta, Alberto Maria Metelli, Giorgia Ramponi, Andrea Tirinzoni, Matteo Giuliani, and Marcello Restelli. Handling non-stationary experts in inverse reinforcement learning: A water system control case study. *Challenges of Real-World RL Workshop @ NeurIPS 2020*, 2020.

[W6] Giorgia Ramponi, Alberto Maria Metelli, Alessandro Concetti, and Marcello Restelli. Online learning in non-cooperative configurable markov decision process. *AAAI-21 Workshop on Reinforcement Learning in Games*, 2021.

In Preparation or Under Review

[P1] Alberto Maria Metelli, Guglielmo Manneschi, and Marcello Restelli. Policy space identification in configurable environments. *CoRR*, abs/1909.03984, 2019.

[P2] Alberto Maria Metelli, Matteo Pirotta, Daniele Calandriello, and Marcello Restelli. Safe policy iteration: A monotonically improving approximate policy iteration approach. 2019. (*Under review for JMLR*).

Milan, March 17, 2021