# Alberto Maria Metelli

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## Summary

Alberto Maria Metelli obtained the Master's Degree in Computer Science and Engineering in July 2017 at Politecnico di Milano defending a thesis on Inverse Reinforcement Learning. He is currently a Ph.D. Student at Politecnico di Milano under supervision of Prof. Marcello Restelli. His main research interests revolve around Machine Learning, in particular Reinforcement Learning, Artificial Intelligence, Numerical Optimization and Recommendation Systems.

## Education

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| 11/2017–present | **Ph.D. Student in Information Technology**, *Politecnico di Milano*, Milan, Italy. <br> Supervisor: Prof. Marcello Restelli |
| 10/2015–07/2017 | **M.Sc. in Computer Science and Engineering**, *Politecnico di Milano*, Milan, Italy. <br> *Final Mark*: 110/110 cum Laude <br> *Master's thesis*: "Compatible Reward Inverse Reinforcement Learning", Supervisor: Prof. Marcello Restelli, Co-supervisor: Matteo Pirotta, Ph.D. |
| 09/2012–07/2015 | **B.Sc. in Computer Science and Engineering**, *Politecnico di Milano*, Milan, Italy. <br> *Final Mark*: 110/110 cum Laude |
| 09/2007–07/2012 | **High School Diploma**, *IISS Ettore Majorana*, Seriate (Bg), Italy. <br> Undergraduate Industrial Engineer, specialization Computer Science <br> *Final Mark*: 100/100 cum Laude |

## Experience

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| 03/2012–06/2012 | **Freelance developer**. <br> Design and implementation of a database system to manage organization and scheduling of remedial courses (corsi di recupero) for IISS Ettore Majorana, Seriate. |
| 06/2011–07/2011 | **Internship**, *Poligrafica s.r.l.*, Dalmine (Bg), Italy. |
| 01/2012–02/2012 | Design and implementation of a mobile application (Android) for composing and printing flyers. |

## Awards

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| 2018 | Winner of Premio NeoLaureati *Leonardo Lesmo* 2018 (AIxIA) for the best Italian Master Thesis in Artificial Intelligence. |
| 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). |

2017 Second place at *ACM RecSys Challenge 2017* (with a team of 8 students from Politecnico di Milano).

2014 Winner of *Le migliori matricole dell'A.A. 2012/2013* (best freshman students) award from Politecnico di Milano.

2012 Enrollement to the *Albo Nazionale delle Eccellenze* (National Register of Eccellences) among best high-school graduates.

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).

2011 Bronze medal at *Olimpiadi Italiane di Informatica 2011* (Italian Olympiad in Informatics).

## Languages

Italian **Mother tongue**

English **Excellent**

06/12 FCE (First Certificate in English), University of Cambridge

## IT Certifications

06/2012 EUCIP IT Administrator Fundamentals, AICA.

05/2012 EUCIP IT Administrator, AICA, *Modules: PC Hardware, Operating System, LAN and Network Services, Network Expert Use, IT Security*.

05/2012 CCNA Discovery Networking for Home and Small Businesses, Cisco Networking Academy.

02/2011 IT Essentials: PC Hardware and Software, Cisco Networking Academy.

11/2009 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 Industriale e dell'Informazione, 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 Industriale e dell'Informazione, 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 D'Oro, "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)
- Guglielmo Manneschi, "Exploiting Environment Configuration for Policy Space Identification". Co-supervision. Supervisor: Prof. Marcello Restelli (M.Sc. in Computer Science and Engineering, October 2019)
- 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)

### Project Tutoring

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

## Talks

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| 11/2017 | Seminar on "Distributional Reinforcement Learning", Politecnico di Milano, Milan, Italy. |
| 07/2018 | Long talk on "Configurable Markov Decision Processes", ICML 2018, Stockholmsmässan, Stockholm, Sweden. |
| 11/2018 | Talk on "Compatible Reward Inverse Reinforcement Learning", AIxIA 2018, Trento, Italy. |
| 06/2019 | Short talk on "Reinforcement Learning in Configurable Continuous Environments", ICML 2019, Long Beach Convention Center, Long Beach. |
| 07/2019 | Talk on "Control Frequency Adaptation via Action Persistence in Batch Reinforcement Learning ", ICML 2020, Online. |

## Editorial Activities

### International Conference Reviewer/Program Committee Member

- International Joint Conference on Artificial Intelligence (IJCAI): 2018 Review Assistant (1 paper), 2020 PC (4 papers)

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

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

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

- International Conference on Artificial Intelligence and Statistics (AISTATS): 2020 PC (6 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)

### 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)

## Participation in Research Projects

01/2018–03/2020 **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.

10/2019–present **Reinforcement Learning for Driver Modeling**, *Ferrari*.
Topic: Development of a reinforcement learning system able to model a human driver in a Formula 1 simulator.
Role: Research scientist.
Project Leader: Prof. Marcello Restelli.

## Summer Schools

10/2017 ACAI Summer School on Reinforcement Learning, Nieuwpoort, Belgium.

## Publications

### International Conferences

[C1] 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, Vienna, Austria, PMLR 119, 2020.*, pages 4102–4113. 2020. **Acceptance rate: 1088/4990 (21.8%)**.

[C2] 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.

[C3] 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, The Thirty-Second Innovative Applications of Artificial Intelligence Conference, IAAI 2020, The Tenth AAAI Symposium on Educational Advances in Artificial Intelligence, EAAI 2020, New York, NY, USA, February 7-12, 2020*, pages 3801–3808. AAAI Press, 2020. **Acceptance rate: 1591/7737 (20.6%)**.

[C4] 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%)**.

[C5] 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.

[C6] 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%)**.

[C7] 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%)**.

[C8] 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%)**.

[C9] 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%)**.

[C10] 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 Journals

[J1] 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.

[J2] 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.

[J3] Alberto Maria Metelli, Matteo Pirotta, and Marcello Restelli. On the use of the policy gradient and hessian in inverse reinforcement learning. *Intelligenza Artificiale*, 2019. (*to appear*).

## 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.

## 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 revision for JMLR*).

[P3] 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. 2020. (*Under revision for MLJ, Special Issue on Reinforcement Learning for Real Life*).