# Matteo Pirotta

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*updated October 15, 2018*

## Curriculum Vitae

Matteo Pirotta is a research scientist at Facebook AI Research in Paris (France). Before, he was postdoctoral researcher at INRIA – Team SequeL (France). He received his PhD in Computer Science from the Politecnico di Milano (Italy) in 2016. His main research interest is in machine learning, in particular *reinforcement learning* and online learning. His works are equally balanced between theory and applications. Dr. Pirotta has been employed in industry and has worked as scientific advisor.

## Work Experience

**10/18–present** **Facebook AI Research**, *(Paris, France)*, Research Scientist.

**01/17–10/18** **INRIA - Team SequeL**, *(Lille, France)*, Postdoctoral Researcher.
Working with A. Lazaric
- June 2018: ranked first for the research scientist position at INRIA Lille (Concours des Chargés de recherche de class normal 2018 - CRCN-LNE)

**06/16–12/16** **Politecnico di Milano**, *(Milano, Italy)*, Postdoctoral Researcher.
Working with Prof. M. Restelli

**11/15–05/16** **UniCredit**, *(Milano, Italy)*, Artificial Intelligence, ICT Project Manager.
Member of a small team applying machine learning to solve complex real problems.

## Education

**01/16** **PhD in Information Technology**, *Politecnico di Milano*, *PhD cum laude*.
Thesis: *"Reinforcement Learning: from Theory to Algorithms."*
Supervisors: Prof. L. Bascetta and Prof. M. Restelli
**Awards:**
- *Dimitris N. Chorafas Foundation Award 2016*.
- *Honourable mention* for the EurAI Distinguished Dissertation Award 2015.

**Research visits:**
- Intelligent Autonomous Systems, Technische Universitaet Darmstadt, Darmstadt (Germany), March-August 2015. Headed by Prof. Jan Peters.

**PhD Schools:**
- Online Learning Summer School, Copenhagen (Denmark), July 2015
- Machine Learning Summer School, Tübingen (Germany), August-September 2013
- Regularization Methods For High Dimensional Learning, Genova (Italy), June 2013

**09/12** **Master of Science in Computer Engineering**, *Politecnico di Milano*, *110/110 cum laude*.
Thesis: *"Safe Policy Iteration: A Monotonically Improving Approximate Policy Iteration Approach."*
**Awards:**
- Special mention from AI*IA (Associazione Italiana per l'Intelligenza Artificiale) among best Italian master thesis

## Honors

09/16    *Dimitris N. Chorafas Foundation Award 2016* (PhD thesis).

09/16    *Honourable mention* for the EurAI Distinguished Dissertation Award 2015 (PhD thesis).

12/12    *Special mention* from AI*IA (Associazione Italiana per l'Intelligenza Artificiale) among best Italian master thesis.

# Publications

## In Preparation or Under Review

[P3]   J. Qian, R. Fruit, M. Pirotta and A. Lazaric. "Exploration Bonus for Regret Minimization in Undiscounted Discrete and Continuous Markov Decision Processes".

[P2]   M. Pirotta and M. Restelli. "Cost-Sensitive Approach to Batch Size Adaptation for Gradient Descent". arXiv:1712.03428.

[P1]   M. Pirotta, S. Balloccu, M. Restelli and L. Bascetta. "Cutting-Plane Inverse Reinforcement Learning"

## International Journals

[J4]   S. Parisi, M. Pirotta and J. Peters. "Manifold-based Multi-objective Policy Search with Sample Reuse". In: *Neurocomputing 263* (November 2017), pp. 3–14.

[J3]   G. Manganini, M. Pirotta, M. Restelli, L. Piroddi and M. Prandini. "Policy search for the optimal control of Markov decision processes: a novel particle-based iterative scheme". In: *IEEE Transactions on Cybernetics 46:11* (November 2016), pp. 2643–2655.

[J2]   S. Parisi, M. Pirotta and M. Restelli. "Multi-objective Reinforcement Learning through Continuous Pareto Manifold Approximation". In: *Journal of Artificial Intelligence Research 57* (October 2016), pp. 187–227.

[J1]   M. Pirotta, M. Restelli and L. Bascetta. "Policy Gradient in Lipschitz MDPs". In: *Machine Learning 100* (September 2015), pp. 255–283.

## International Conferences and Workshops

[C22]   R. Fruit, M. Pirotta, and A. Lazaric. "Near Optimal Exploration-Exploitation in Non-Communicating Markov Decision Processes". In: *Advances in Neural Information Processing Systems 31, Montréal, Canada, December 2018.* (acceptance rate: 1011/4856 (20.82%), spotlight: 168/1011 (16.62%))

[C21]   R. Fruit, M. Pirotta, A. Lazaric and R. Ortner. "Efficient Bias-Span-Constrained Exploration-Exploitation in Reinforcement Learning". In: *Proc. of 35th International Conference on Machine Learning, ICML, Stockholm, Sweden, July 2018.* (acceptance rate: 618/2473 (24.99%))

[C20]   M. Papini, D. Binaghi, G. Canonaco, M. Pirotta and M. Restelli. "Stochastic Variance-Reduced Policy Gradient". In: *Proc. of 35th International Conference on Machine Learning, ICML, Stockholm, Sweden, July 2018.* (acceptance rate: 618/2473 (24.99%))

[C19]   A. Tirinzoni, A. Sessa, M. Pirotta and M. Restelli. "Importance Weighted Transfer of Samples in Reinforcement Learning". In: *Proc. of 35th International Conference on Machine Learning, ICML, Stockholm, Sweden, July 2018.* (acceptance rate: 618/2473 (24.99%))

[C18]   D. Di Febbo, E. Ambrosini, M. Pirotta, E. Rojas, M. Restelli, A. Pedrocchi and S. Ferrante. "Does Reinforcement Learning Outperform PID in the Control of FES Induced Elbow Flex-Extension?". In: *Proc. of 13th Annual IEEE International Symposium on Medical Measurements and Applications, Rome, Italy, June 2018.*

[C17]   R. Fruit, M. Pirotta, A. Lazaric and E. Brunskill. "Regret Minimization in MDPs with Options without Prior Knowledge". In: *Advances in Neural Information Processing Systems 30, Long Beach, USA, December 2017.* (acceptance rate: 678/3240 (20.93%), spotlight: 112/678 (16.52%))

[C16]   A. Metelli, M. Pirotta, and M. Restelli. "Compatible Reward Inverse Reinforcement Learning". In: *Advances in Neural Information Processing Systems 30, Long Beach, USA, December 2017.* (acceptance rate: 678/3240 (20.93%))

[C15] M. Papini, M. Pirotta, and M. Restelli. "Adaptive Batch Size for Safe Policy Gradients". In: *Advances in Neural Information Processing Systems 30, Long Beach, USA, December 2017.* (acceptance rate: 678/3240 (20.93%))

[C14] D. Tateo, M. Pirotta, A. Bonarini and M. Restelli. "Gradient-Based Minimization for Multi-Expert Inverse Reinforcement Learning". In: *IEEE Symposium on Adaptive Dynamic Programming and Reinforcement Learning, ADPRL, Hawaii, USA, December 2017.*

[C13] S. Tosatto, M. Pirotta, C. D'Eramo and M. Restelli. "Boosted Fitted Q-Iteration". In: *Proc. of 34th International Conference on Machine Learning, ICML, Sydney, Australia, August 2017.* (acceptance rate: 433/1701 (25.46%))

[C12] C. D'Eramo, A. Nuara, M. Pirotta and M. Restelli. "Estimating the Maximum Expected Value in Continuous Reinforcement Learning Problems". In: *Proc. of 31th AAAI Conference on Artificial Intelligence, AAAI, San Francisco, California, USA, February 2017.* AAAI Press, 2017. (acceptance rate: 638/2590 (24.64%))

[C11] M. Pirotta and M. Restelli. "Inverse Reinforcement Learning through Policy Gradient Minimization". In: *Proc. of the 30th AAAI Conference on Artificial Intelligence, AAAI, Phoenix, Arizona, USA, February 2016.* AAAI Press, 2016. (acceptance rate: 549/2132 (25.8%), oral presentation: 263/2132 (12.3%))

[C10] M. Pirotta, S. Parisi and M. Restelli. "Multi-Objective Reinforcement Learning with Continuous Pareto Frontier Approximation". In: *Proc. of the 29th AAAI Conference on Artificial Intelligence, AAAI, Austin, Texas, USA, January 2015.* AAAI Press, 2015. (acceptance rate: 531/1991 (26.7%))

[C9] D. Caporale, L. Deori, R. Mura, A. Falsone, R. Vignali, L. Giulioni, M. Pirotta and G. Manganini. "Optimal Control to Reduce Emissions in Gasoline Engines: An Iterative Learning Control Approach for ECU Calibration Maps Improvement". In: *European Control Conference, ECC, Linz, Austria, July 2015.*

[C8] G. Manganini, M. Pirotta, M. Restelli and L. Bascetta. "Following Newton Direction in Policy Gradient with Parameter Exploration". In: *Proc. of the International Joint Conference on Neural Networks, IJCNN, Killarney, Ireland, July 2015.*

[C7] S. Parisi, M. Pirotta, N. Smacchia, L. Bascetta and M. Restelli. "Policy Gradient Approaches for Multi-Objective Sequential Decision Making: A Comparison". In: *IEEE Symposium on Adaptive Dynamic Programming and Reinforcement Learning, ADPRL, Orlando, Florida, USA, December 2014.* IEEE, 2014.

[C6] S. Parisi, M. Pirotta, N. Smacchia, L. Bascetta and M. Restelli. "Policy Gradient Approaches for Multi-Objective Sequential Decision Making". In: *Proc. of the International Joint Conference on Neural Networks, IJCNN, Beijing, China, July 2014.*

[C5] M. Pirotta, G. Manganini, L. Piroddi, M. Prandini and M. Restelli. "A particle-based policy for the optimal control of Markov decision processes". In: *Proc. of the 19th IFAC World Congress, IFAC, Cape Town, South Africa, August 2014.*

[C4] M. Pirotta, M. Restelli and L. Bascetta. "Adaptive Step-Size for Policy Gradient Methods". In: *Advances in Neural Information Processing Systems 27, NIPS, Lake Tahoe, Nevada, USA, December 2013.* (acceptance rate: 360/1420 (25.3%))

[C3] M. Pirotta, M. Restelli, A. Pecorino, and D. Calandriello. "Safe policy iteration". In: *Proc. of the 30th International Conference on Machine Learning, ICML, Atlanta, Georgia, USA, July 2013.* (acceptance rate: 283/1204 (23.5%); oral presentation: 143/1204 (11.9%))

[C2] M. Migliavacca, A. Pecorino, M. Pirotta, M. Restelli and A. Bonarini. "Fitted Policy Search". In: *IEEE Symposium on Adaptive Dynamic Programming and Reinforcement Learning, ADPRL, Paris, France, April 2011.* IEEE, 2011.

[C1] M. Migliavacca, A. Pecorino, M. Pirotta, M. Restelli and A. Bonarini. "Fitted Policy Search: Direct Policy Search using a Batch Reinforcement Learning Approach". In: *Proc. of the 3rd International*

*Workshop on Evolutionary and Reinforcement Learning for Autonomous Robot Systems, ERLARS, Lisboa, Portugal, August 2010.*

## Teaching Activities and Supervision

2018    **Teaching assistant**, *École Normale Supérieure Cachan*, Paris, France.
Course "Reinforcement Learning", Prof. A. Lazaric,
Master MVA2 Mathématiques/Vision/Apprentissage

2017    **Teaching assistant**, *École Normale Supérieure Cachan*, Paris, France.
Course "Reinforcement Learning", Prof. A. Lazaric,
Master MVA2 Mathématiques/Vision/Apprentissage

2015    **Teaching assistant**, *Politecnico di Milano*, Milano, Italy.
Course "Fondamenti di Informatica", Prof. C. Bolchini, Bachelor in Computer Engineering

2014    **Laboratory Tutor**, *Politecnico di Milano*, Milano, Italy.
Course "Informatica A", Prof. O. Mejri, Bachelor in Business Engineering

2014    **Laboratory Tutor**, *Politecnico di Milano*, Milano, Italy.
Course "Informatica B", Prof. V. Zaccaria, Bachelor in Mechanical Engineering

2013    **Teaching assistant**, *Politecnico di Milano*, Milano, Italy.
Course "Robotics", Prof. M. Restelli, Bachelor in Computer Engineering

2013    **Laboratory Tutor**, *Politecnico di Milano*, Milano, Italy.
Course "Fondamenti di Automatica", Prof. L. Bascetta, Bachelor in Aerospace Engineering

### Supervision of Master's Students

Since 2014 I have been co-supervisor of more than 20 master thesis.

## Scientific Activities

- Program Committee and Reviewer: AAAI (2017-2019), NIPS (2015, 2016, 2018), IJCAI (2017, 2018), RLDM (2017)

- Journal Reviewer: Journal of Machine Learning Research, Adaptive Behavior, IEEE Transactions on Robotics, Automatica

- **Workshop organizer**:

  - *Prediction and Generative Modeling in Reinforcement Learning.* Federated AI Meeting of AAMAS, ICML, and IJCAI (FAIM), July 2018, Stockholm, Sweden. Co-organized with Roberto Calandra (UC Berkeley), Sergey Levine (UC Berkeley), Martin Riedmiller (DeepMind) and Alessandro Lazaric (Facebook AI Research).

  - *The 14th European Workshop on Reinforcement Learning (EWRL 2018).* October 2018, Lille, France.

## Project and Funding

### Research Projects

2017    **Principal Investigator**, *Theoretically grounded efficient algorithms for high-dimensional and continuous reinforcement learning*, (PGMO Project).
Exploration-Exploitation in Reinforcement Learning.

2013    **Investigator**, *FIDELIO - FIxtureless DEburring of wheeLs by human demonstratIOn*, (EU Project).
Reinforcement Learning for deburring of wheels.

### Industrial Projects

2016–2017    **Investigator**, *Reinforcement Learning for DVA Hedging*, Reply s.p.a..
Automatic DVA hedging via reinforcement learning.

2016–2017 **Investigator**, *Machine Learning for Swaption Calibration*, Intesa San Paolo Group Service.
Data-driven model for swaption calibration.

2016 **Investigator**, *Development of data-driven models for Cyber Tyre*, Pirelli s.p.a..
Detection of inflating point from tyre sensor data.