

# Matteo Pirotta

Postdoctoral Researcher at INRIA

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## Curriculum Vitae

Matteo Pirotta is a 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 *reinforcement learning* and online learning. His works are equally balanced between theory and applications. A particular focus is posed on financial applications involving portfolio management and trading, just to mention a few. Dr. Pirotta has been employed in industry and has worked as scientific advisor.

## Work Experience

- 01/17–present **INRIA - Team SequeL**, (Lille, France), Postdoctoral Researcher.  
Supervisor: Prof. A. Lazaric
- 06/16–12/16 **Politecnico di Milano**, (Milano, Italy), Postdoctoral Researcher.  
Supervisor: 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.

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## Publications

### In Preparation or Under Review

- [P3] R. Fruit, M. Pirotta, A. Lazaric and R. Ortner. “Efficient Bias-Span-Constrained Exploration-Exploitation in Reinforcement Learning”. Submitted to ICML 2018 (arXiv:1802.04020)
- [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

- [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*.

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## Teaching Activities and Supervision

- 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.

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## Scientific Activities

- Program Committee and Reviewer: AAAI (2017,2018), NIPS (2015,2016), 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).

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## Project and Funding

### 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.

### Research Projects

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