# Alessandro Lazaric

Curriculum Vitæ

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### **Academic Positions**

Junior Researcher (CR1), INRIA - Team SequeL, Lille, France.

2008 2010

2008

Junior Researcher (CR2), INRIA - Team SequeL, Lille, France.

Postdoctoral Researcher, INRIA - Team SequeL, Lille, France. Supervisor: Prof. Rémi Munos.

Postdoctoral Researcher, Politecnico di Milano, Milan, Italy.

Supervisor: Prof. Andrea Bonarini.

#### Education



PhD Computer Engineering, Politecnico di Milano, Milan, Italy.

PhD thesis: "Knowledge Transfer in Reinforcement Learning". Supervisors: Prof. Andrea Bonarini, Dr. Marcello Restelli. Examiner: Peter Stone (The University of Texas at Austin).



MSc Computer Engineering, University of Illinois at Chicago (UIC), Chicago, IL, USA. Master thesis: "Learning with multiple state aggregation representations". Master advisor: Prof. Piotr Gmytrasiewicz.

MSc Computer Engineering (Cum Laude), Politecnico di Milano, Milan, Italy. Master thesis: "A Multi-Resolution Reinforcement Learning Approach to the Efficient Solution of Complex Problems". Supervisor: Prof. Andrea Bonarini.

#### **Awards**

- INRIA award for scientific excellence (prime d'exellence scientifique) (2013-2016)
- o Winner of a Ph.D. scholarship granted by the Italian Ministry of Education, University and Research by ranking second among the Ph.D. applicants at Politecnico di Milano (Italy)
- M.S. with honors. Politecnico di Milano (Italy)

### Languages

Italian Native

English Fluent

French Fluent

# Teaching and Supervision

### Lecturer

2013

Reinforcement Learning, ENS Cachan - Master 2 MVA, Cachan, France.

Introduction to Reinforcement Learning, Ecole Centrale de Lille - Option Décision et Analyse de Données, Lille, France.

2012	<b>Advanced Topics in Machine Learning</b> , <i>Politecnico di Milano – PhD Course</i> , Milan, Italy. Focused on statistical learning theory, online learning, and multi-armed bandit.
	Teaching Assistant
2008	Computer Science III, Politecnico di Milano, Milan, Italy. Lecturer: Prof. Marcello Restelli
2007	Principles of Computer Science, Politecnico di Milano, Milan, Italy.  Lecturer: Prof. Andrea Bonarini
2006	<b>Software Engingeering</b> , <i>Politecnico di Milano</i> , Milan, Italy. <i>Lecturer:</i> Prof. Andrea Morzenti
2005	Principles of Computer Science (C), Politecnico di Milano, Milan, Italy.  Lecturer: Prof. Matteo Matteucci
2005	Artificial Intelligence and Robotics, Politecnico di Milano, Milan, Italy.  Lecturer: Prof. Marcello Restelli
	PhD Supervision
2014	<b>Daniele Calandriello</b> , <i>Large-scale Graph Learning</i> , Université de Lille, France. <i>Co-supervisor:</i> Michal Valko, Philippe Preux
2014	Marc Abeille, Reinforcement Learning for Trading, ENS Cachan, France. Co-supervisor: Rémi Munos
2012	<b>Marta Soare</b> , <i>Exploration–exploitation in Linear Bandit</i> , Université de Lille, France. <i>Co-supervisor:</i> Rémi Munos
2011	Amir Sani, Risk in Machine Learning, Université de Lille, France. Co-supervisor: Rémi Munos
	PhD Examiner
2014	Mahdi Milani Fard, McGill University, Montreal, Canada.  Supervisor: Prof. Joelle Pineau
	MsC Supervision
2014	<b>Daniele Calandriello</b> , <i>Sparse Multi-task Reinforcement Learning</i> , Politecnico di Milano, Milan, Italy.
2011	Co-supervisor: Marcello Restelli. Best MsC thesis award at Al*IA 2014.
	Francesco Trovò, Regret Estimation for Multi Slot Incentive Compatible Multi Armed bandit, Politecnico di Milano, Milan, Italy.  Co-supervisor: Nicola Gatti, Erkki Oja. Francesco is currently a PhD student at Politecnico di
2007	Milano.  Mario Quaresimale, Analysis of Opponent Modeling for improving Reinforcement Learning Agents in the Kuhn Poker Game, Politecnico di Milano, Milan, Italy.
2007	Co-supervisor: Marcello Restelli
•	<b>Emanuele Venneri</b> , Macro-actions Optimization in Multi-Task Reinforcement Learning, Politecnico di Milano, Milan, Italy.  Co-supervisor: Marcello Restelli
2007	<b>Eliseo Ferrante</b> , Transfer of Knowledge in Reinforcement Learning through Policy-based Proto- Value Functions., Politecnico di Milano, Milan, Italy.
	Co-supervisor: Marcello Restelli. Eliseo is currently a postdoctorate researcher at "Socio-ecology and Social Evolution" laboratory in K.U. Leuven
2007	Alessandro Prete, Learning Driving Tasks in a Racing Game Using Reinforcement Learning, Politecnico di Milano, Milan, Italy.  Co-supervisor: Marcello Restelli

2007	Francesco Recchia and Guglielmo Roelsfema, Bound Algorithms for Learning Optimal Policies using State Aggregation, Politecnico di Milano, Milan, Italy.  Co-supervisor: Marcello Restelli
2007	<b>Nicola Parolini and Giorgio Pandolfi</b> , <i>Multiagent Reinforcement Learning in Extended Form Games: the Bilateral Bargaining</i> , Politecnico di Milano, Milan, Italy. <i>Co-supervisor:</i> Marcello Restelli
2007	Mario Lozza, Reinforcement Learning in Texas Hold-em Poker, Politecnico di Milano, Milan, Italy.  Co-supervisor: Marcello Restelli
2007	Matteo Lazzarotto, Factored Representation for Intrinsically Motivated Reinforcement Learning, Politecnico di Milano, Milan, Italy.  Co-supervisor: Marcello Restelli
2006	<b>Simone Tognetti</b> , Analysis and Application of Algebraic Transformations in Partially Symmetric Environments for Learning Speed Improvement, Politecnico di Milano, Milan, Italy. Co-supervisor: Marcello Restelli
2005	Francesco Carsana e Ilario Ceruti, Multi-resolution Approximation in Hierarchical Reinforcement Learning for Complex Environment, Politecnico di Milano, Milan, Italy. Co-supervisor: Marcello Restelli
2005	<b>Patrick Vitali</b> , Autonomous Development for Artificial Agents through Self-Regulated Learning, Politecnico di Milano, Milan, Italy.  Co-supervisor: Marcello Restelli
	MsC Examiner
2012	Matteo Pirotta, Alessio Pecorino, Safe Policy Iteration: A Monotonically Improving Approximate Policy Iteration Approach, Politecnico di Milano, Milan, Italy. Supervisor: Marcello Restelli.
2008	<b>Sofia Ceppi</b> , Characterization of Equilibria in Energy Markets Using Decentralized Auctions, Politecnico di Milano, Milan, Italy.  Supervisor: Nicola Gatti.
	Project Funding
2015	<b>EduBand (Educational Bandit)</b> , Associate Team with Carnegie Mellon University, Funding: 50,000 €.
2014	Collaborators: Emma Brunskill, Michal Valko
2014	ExTra-Learn (Extraction and Transfer of Knowledge in Reinforcement Learning), $ANR$ - $JCJC$ , $Funding$ : $250,000 \in$ .
2011	ComLACS (Composing Learning for Artificial Cognitive Systems), EU FP7.  Pl: John Shawe-Taylor. Partners: University College London (UCL), University of Bristol (UB), Royal Holloway, University of London, Radboud Universiteit Nijmegen, Technische Universitat Berlin,
2009	Montanuniversitat Leoben, Inria, Technische Universität Darmstadt. <b>Explo-RA (Exploration-Exploitation for Efficient Resource Allocation, applications to optimization, control, learning and games)</b> , <i>ANR</i> . <i>PI:</i> Rémi Munos. <i>Partners:</i> Inra, HEC Paris, Les Ponts, Paris 5, Paris 8.
	Organization of Scientific Events
2015	12th European Workshop on Reinforcement Learning (EWRL), Chair, Lille, France. Co-chair: Mohammad Ghavamzadeh, Rémi Munos.

2009	ICML Workshop on "On-line Learning with Limited Feedback", Chair, Montreal, Canada.
	Co-chair: JY. Audibert, P. Auer, R. Munos, D. Ryabko, C. Szepesvari.
	Tutorials and Invited Talks
2014	<b>Invited Talk on "Transfer in Reinforcement Learning"</b> , 30 minutes de sicence, INRIA, Lille, France.
2014	Invited Talk on "Approximate Dynamic Programming Meets Statistical Learning Theory", GDR "Controle des décollements" and GDR MOSAR, Paris, France.  Host: L. Mathelin.
2013	Tutorial on "Statistical Learning Theory in Reinforcement Learning and Approximate Dynamic Programming", Lecturer, EWRL-13, Daghstul, Germany. Co-organizers: M. Ghavamzadeh.
2013	Invited Talk on "Transfer of Samples from Multiple MDPs", Carnegie Mellon University, Pittsburgh, USA.  Host: E. Brunskill.
2012	Invited Talk on "Recent Advancements on Multi-Armed Bandit", Politecnico di Milano, Milan, Italy.  Host: M. Restelli.
2012	Tutorial on "Statistical Learning Theory in Reinforcement Learning and Approximate Dynamic Programming", Lecturer, ICML-12, Edinburgh, UK.  Co-organizers: M. Ghavamzadeh.
2011	Invited Talk on "Transfer of Samples from Multiple MDPs", Université de Liège, Liège, Belgium.  Host: D. Ernst.
2010	Invited Talk on "Analysis of a Classification-based Policy Iteration Algorithm", University of Alberta, Edmonton, Canada.  Host: Cs. Szepesvari.
2010	<b>Tutorial on "Reinforcement Learning and Beyond"</b> , <i>Lecturer</i> , AAMAS-10, Toronto, Canada. <i>Co-organizers:</i> K. Verbeeck, J. Steven, P. Vrancx, M. E. Taylor, F. S. Melo.
2009	<b>Tutorial on "Reinforcement Learning and Beyond"</b> , <i>Lecturer</i> , AAMAS-09, Budapest, Hungary. <i>Co-organizers:</i> K. Verbeeck, J. Steven, P. Vrancx, M. E. Taylor, F. S. Melo.
2009	Invited Talk on "Transfer in Reinforcement Learning: It's All About Similarity", Barbados Reinforcement Learning Workshop, McGill's Bellairs Institute, Barbados.
2009	<b>Tutorial on "Transfer Learning for Reinforcement Learning Domains"</b> , <i>Lecturer</i> , ECML-09, Bled, Slovenia. <i>Co-organizers:</i> M. E. Taylor.
2008	Invited Talk on "Knowledge Transfer in Reinforcement Learning", IRIDIA, Bruxelles,

# Responsibilities

Host: C. Pinciroli, M. Dorigo.

Belgium.

Program Committee and Reviewer: ICML (2009–), NIPS (2009–), ECML (2010), AAMAS (2011-2013), AAAI (2010,2011,2014,2015), ICRA (2010), IJCAI (2009, 2011, 2013, 2015), COLT (2010-2014), ALT (2010, 2014), RLDM (2015), JFPDA (2013, 2014), UAI (2012), CDC (2012), various workshops.

- Journal Reviewer: JMLR, MLJ, JAIR, JOTA, IEEE Information Theory, IEEE TAC, JAAMAS.
- Member of the selection committee for junior researcher positions at INRIA Lille (2015).
- Member of the selection committee for PhD and postdoctorate positions at INRIA Lille (2014, 2015).
- o Member of the selection committee for "delegation" positions at INRIA Lille (2014).
- o Responsible for the Activity Report of SequeL (2011, 2012).
- Responsible for the reading group on "Multi-armed Bandit" at SequeL (2009).

### Journal Publications

2012

2014

2013

2009

Lazaric, A., M. Ghavamzadeh, and R. Munos. "Finite-Sample Analysis of Least-Squares Policy Iteration". In: *Journal of Machine learning Research (JMLR)*.

Lazaric, Alessandro and Rémi Munos. "Learning with stochastic inputs and adversarial outputs". In: *Journal of Computer and System Sciences (JCSS)* 78.5, pp. 1516–1537.

Bonarini, Andrea, Alessandro Lazaric, Francesco Montrone, and Marcello Restelli. "Reinforcement distribution in fuzzy Q-learning". In: *Fuzzy Sets and Systems* 160.10, pp. 1420–1443.

## Conference Publications

Calandriello, D., A. Lazaric, and M. Restelli. "Sparse Multi-task Reinforcement Learning". In: Proceedings of the Twenty-Eigth Annual Conference on Neural Information Processing Systems (NIPS'14).

Gheshlaghi-Azar, M., A. Lazaric, and E. Brunskill. "Resource-efficient Stochastic Optimization of a Locally Smooth Function under Correlated Bandit Feedback". In: *Proceedings of the Thirty-First International Conference on Machine Learning (ICML'14)*.

Sani, A., G. Neu, and A. Lazaric. "Exploiting easy data in online optimization". In: *Proceedings of the Twenty-Eigth Annual Conference on Neural Information Processing Systems* (NIPS'14).

Soare, M., A. Lazaric, and R. Munos. "Best-arm Identification in Linear Bandit". In: *Proceedings of the Twenty-Eigth Annual Conference on Neural Information Processing Systems (NIPS'14)*.

Gheshlaghi-Azar, M., A. Lazaric, and E. Brunskill. "Regret Bounds for Reinforcement Learning with Policy Advice". In: *Proceedings of the European Conference on Machine Learning (ECML'13)*.

Gheshlaghi-Azar, M., A. Lazaric, and E. Brunskill. "Sequential Transfer in Multi-arm Bandit with Finite Set of Models". In: *Proceedings of the Twenty-Seventh Annual Conference on Neural Information Processing Systems (NIPS'13)*.

2012	Gabillon, Victor, Mohammad Ghavamzadeh, and Alessandro Lazaric. "Best Arm Identification: A Unified Approach to Fixed Budget and Fixed Confidence". In: <i>Proceedings of the Twenty-Sixth Annual Conference on Neural Information Processing Systems (NIPS'12)</i> .
2012	Gatti, Nicola, Alessandro Lazaric, and Francesco Trovò. "A Truthful Learning Mechanism for Multi-Slot Sponsored Search Auctions with Externalities (Extended Abstract)". In: Proceedings of the 13th ACM Conference on Electronic Commerce (EC'12).
2012	Geist, Matthieu, Bruno Scherrer, Alessandro Lazaric, and Mohammad Ghavamzadeh. "A Dantzig Selector Approach to Temporal Difference Learning". In: <i>Proceedings of the Thirtieth International Conference on Machine Learning (ICML-2012)</i> .
2012	Ghavamzadeh, Mohammad and Alessandro Lazaric. "Conservative and Greedy Approaches to Classification-based Policy Iteration". In: <i>Proceedings of the 26th Conference on Artificial Intelligence (AAAI'12)</i> .
2012	Sani, Amir, Alessandro Lazaric, and Rémi Munos. "Risk Averse Multi-Arm Bandits". In: Proceedings of the Twenty-Sixth Annual Conference on Neural Information Processing Systems (NIPS'12).
2012	Valko, Michal, Mohammad Ghavamzadeh, and Alessandro Lazaric. "Semi-Supervised Inverse Reinforcement Learning". In: <i>Proceedings of the 10th European Workshop on Reinforcement Learning</i> .
2011	Carpentier, Alexandra, Alessandro Lazaric, Mohammad Ghavamzadeh, Rémi Munos, and Peter Auer: "Upper-confidence-bound Algorithms for Active Learning in Multi-armed Bandits". In: Proceedings of the 22nd International Conference on Algorithmic Learning Theory (ALT'11).
2011	Gabillon, Victor, Alessandro Lazaric, Mohammad Ghavamzadeh, and Sebastien Bubeck. "Multi-bandit Best Arm Identification". In: <i>Proceedings of the Twenty-Fifth Annual Conference on Neural Information Processing Systems (NIPS'11)</i> , pp. 2222–2230.
2011	Gabillon, Victor, Alessandro Lazaric, Mohammad Ghavamzadeh, and Bruno Scherrer. "Classification-based Policy Iteration with a Critic". In: <i>Proceedings of the Twenty-Eigth International Conference on Machine Learning (ICML-2011)</i> .
2011	Ghavamzadeh, M., A. Lazaric, R. Munos, and M. Hoffman. "Finite-Sample Analysis of Lasso-TD". In: <i>Proceedings of the Twenty-Eigth International Conference on Machine Learning (ICML-2011)</i> .
2011	Lazaric, Alessandro and Marcello Restelli. "Transfer from Multiple MDPs". In: <i>Proceedings of the Twenty-Fifth Annual Conference on Neural Information Processing Systems (NIPS'11)</i> .
2010	Ghavamzadeh, M., A. Lazaric, O. A. Maillard, and R. Munos. "LSTD with Random Projections". In: <i>Advances in Neural Information Processing Systems</i> .





Strategies for Classification-based Policy Iteration". In: ICML 2010 Workshop on Reinforce-

ment Learning and Search in Very Large Spaces.

