ANTOINE MOULIN

PhD student in Machine Learning

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RESEARCH INTERESTS

Reinforcement learning (efficient exploration with function approximation, adversarial environments, distribution shift), online learning (adaptive algorithms, post-training of language models).

EDUCATION

Ph.D in Machine Learning   Dec 2021 – Present
Universitat Pompeu Fabra   Barcelona, Spain

· The overarching topic is to identify and exploit structural properties of Markov decision processes that make large-scale reinforcement learning (RL) statistically and computationally feasible.
· Part of the ELLIS program, advised by Gergely Neu and Arthur Gretton.

Master of Science in Machine Learning   Sep 2019 – Sep 2020
ENS Paris-Saclay   Paris, France

· Grade: 17.34/20.00. Courses: RL, Computer Vision, Graphical Models, Convex Optimization, Deep Learning, Neurosciences, Kernel Methods, Sequential Learning, Multi-scale models, Biostatistics.

Engineering Degree   Sep 2017 – Sep 2020
Telecom Paris   Paris, France

· GPA: 4.00/4.00. Equivalent to a Masters, top 5% cohort. Some courses: Measure & Probability Theory, Functional Analysis, Signal Processing, Statistics, Machine Learning, Optimization, Algorithm Design.

Preparatory Classes   Sep 2015 – Jul 2017
Lycée Janson-de-Sailly   Paris, France

· GPA: 3.96/4.00. Post-secondary two-year program in Advanced Mathematics and Physics.

EXPERIENCE

Student Researcher   Jun 2024 – Dec 2024
Google DeepMind   London, UK

· Worked on epistemic uncertainty quantification and how to compute finite-time predictive intervals for general function classes using ensembles and approximations thereof. Advisor: Ilja Kuzborskij.

Research Engineer   Feb 2021 – Apr 2021
Research Intern   May 2020 – Oct 2020
INRIA   Lille, France

· Focus on deep RL. Implemented extensions of actor-critic methods (PPO, TRPO) to improve exploration, worked on reproducibility issues in RL. Advisor: Philippe Preux.

Research Intern   Summer 2019
Aalto University   Helsinki, Finland

· Reviewed the literature on canonical correlation analysis (CCA) methods and implemented an efficient extension of a sparse kernel CCA method. Advisor: Juho Rousu.

Analyst Intern   Summer 2018
Crédit Agricole   Caen, France

PUBLICATIONS & PREPRINTS

A benchmark of expert-level academic questions to assess AI capabilities [Open access] [arXiv]
Center for AI Safety, Scale AI, and **HLE Contributors Consortium**.
Nature, 2026.

Outcome-Aware Spectral Feature Learning for Instrumental Variable Regression [arXiv]
Dimitri Meunier, Jakub Wornbard, Vladimir R Kostic, **Antoine Moulin**, Alek Frölich, Karim Lounici, Massimiliano Pontil, and Arthur Gretton.
(Submitted)

Inverse Q-Learning Done Right: Offline Imitation Learning in Q^π-Realizable MDPs [arXiv]
Antoine Moulin, Gergely Neu, and Luca Viano (α-β order).
(NeurIPS 2025) 39th Annual Conference on Neural Information Processing Systems.

Demystifying Spectral Feature Learning for Instrumental Variable Regression [arXiv]
Dimitri Meunier, **Antoine Moulin**, Jakub Wornbard, Vladimir R Kostic, and Arthur Gretton.
(NeurIPS 2025) 39th Annual Conference on Neural Information Processing Systems.

When Lower-Order Terms Dominate: Improved Loss-Range Adaptivity for Expert Algorithms [arXiv]
Antoine Moulin*, Emmanuel Esposito*, and Dirk van der Hoeven.
(NeurIPS 2025) 39th Annual Conference on Neural Information Processing Systems.

Optimistically Optimistic Exploration for Provably Efficient Infinite-Horizon Reinforcement and Imitation Learning [arXiv]
Antoine Moulin, Gergely Neu, and Luca Viano (α-β order).
(COLT 2025) 38th Annual Conference on Learning Theory.
Contributed talk at the 18th European Workshop on Reinforcement Learning (EWRL 2025).

Spectral Representation for Causal Estimation with Hidden Confounders [arXiv]
Haotian Sun*, **Antoine Moulin***, Tongzheng Ren, Arthur Gretton, and Bo Dai.
(AISTATS 2025) 28th International Conference on Artificial Intelligence and Statistics.

Optimistic Planning by Regularized Dynamic Programming [arXiv]
Antoine Moulin, and Gergely Neu (α-β order).
(ICML 2023) 40th International Conference on Machine Learning.

TALKS

Efficient exploration in linear Markov decision processes		Jan 2026
University of Oxford		Oxford, UK
Tutorial on Imitation Learning		Jan 2026
University of Oxford		Oxford, UK
Efficient exploration in linear Markov decision processes		Nov 2025
Isaac Newton Institute		Cambridge, UK
Inverse Q-Learning for Offline Imitation Learning		Sep 2025
Università degli Studi di Milano		Milan, Italy

Learning in Adversarial Linear MDPs		Mar 2024
University of Tokyo		Tokyo, Japan
Optimistic Planning by Regularized Dynamic Programming		Aug 2023
Princeton University		Princeton, NJ
Optimistic Planning by Regularized Dynamic Programming		Jul 2023
Stanford University		Stanford, CA
Infinite-Horizon RL with Linear Function Approximation		Mar 2023
Universitat Pompeu Fabra		Barcelona, Spain
Primal-dual Methods for RL		Sep 2022
Gatsby Unit, University College London		London, UK
Introduction to JAX		Sep 2021
ELLIS Doctoral Symposium		Tubingen, Germany

TEACHING

Machine Learning	Universitat Pompeu Fabra	2022 – 2023
Algorithm Design	Universitat Pompeu Fabra	2022 – 2024
Computer Science	IPESUP, bootcamp for high-school students	2023
Probabilities	Universitat Pompeu Fabra	2022
Mathematics Examiner	Lycée Janson-de-Sailly, preparatory classes	2018 – 2019

ACADEMIC ACTIVITIES

· Organizer of the NeurIPS 2025 workshop *Aligning Reinforcement Learning Experimentalists and Theorists*.
· Organizer of the RL theory virtual seminars (YouTube channel).
· Organizer of the ICML 2024 workshop *Aligning Reinforcement Learning Experimentalists and Theorists*.
· Organizer of the Reinforcement Learning Summer School 2023 (RLSS 2023).
· Reviewer at EWRL (2023, 2025), ARLET (2024, 2025), NeurIPS (2025), JMLR (2025), ICLR (2026), AISTATS (2026).
· Chair of the ELLIS RL reading group (2021 – 2022).
· Volunteer at AISTATS 2021.

SKILLS

Programming	Python (JAX, PyTorch), MATLAB, C++, Java, SQL, HTML.
Languages	French (native), English (fluent), Spanish, Italian (intermediate).

SCHOLARSHIPS & GRANTS

ELISE/ELSA mobility grants (ELLIS)	2022, 2024, 2025
Doctoral scholarship, Universitat Pompeu Fabra	2021
Doctoral scholarship, University of Cambridge (declined)	2021
Doctoral scholarship, University of Geneva (declined)	2021
Research studentship (Gatsby Unit), University College London (declined)	2021
3rd place for "Virtual Sculpture" at Innovation Day, Telecom Paris	2018

OTHER ACTIVITIES

· Organizer of the beach volley tournament at DTIC, Universitat Pompeu Fabra (2022 – 2023).
· Communication manager in a student-led company at Telecom Paris (2018 – 2019). Organized workshops, study cases, visits and a gala for students & partner companies (€27K budget). Managed missions in Machine Learning for several companies.
· Hobbies include climbing, (beach) volleyball, ski, table tennis.