Matteo Bettini

Researcher in multi-agent learning

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Matteo Bettini
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Interested and experienced in reinforcement learning, multi-robot systems, and graph neural networks

Education

Oct 2021 – Mar 2025 **PhD in Computer Science**, *University of Cambridge*, UK
Thesis: *Neural diversity in multi-agent learning* , Supervisor: Prof. Amanda Prorok
- Published **9 research papers** [2–10] at top conferences (e.g., ICML, ICLR, AAMAS) and journals (JMLR)
- Focus on studying [5], measuring [4], and controlling [2] behavioral diversity in multi-agent reinforcement learning
- Created and maintained *VMAS* [6] **(460+ stars)**, a vectorized simulator and task collection written in PyTorch
- Deployed and demonstrated research on a fleet of Cambridge Robomaster autonomous mobile ground robots [10]

2020–2021 **MPhil in Advanced Computer Science**, *University of Cambridge*, UK
Distinction, GPA: 87.09/100, Supervisor: Prof. Amanda Prorok
Thesis on transport network design for multi-agent routing using genetic algorithms and reinforcement learning

2017–2020 **BEng in Computer Engineering**, *Politecnico di Milano*, Italy
110 Cum Laude/110 (Honors), GPA: 29.16/30
Project on software engineering: reinvented board game "Santorini" in Java with online multiplayer and 3D graphics

Experience

Work

May–Nov 2025 **Meta, Superintelligence Labs**, *Research Scientist Intern (PhD)*, Paris, France
Working in the Meta Agents team on online RL training of agentic LLMs. Published the ARE agentic benchmark [12]
- Researched training recipes for long-horizon tasks with tools and sparse rewards (e.g. deep research, smartphone use)
- Built distributed training pipelines for 70B models on large-scale GPU clusters, focusing on efficiency and parallelism

Jun–Oct 2023 **Meta, PyTorch**, *Machine Learning Engineer Intern (PhD)*, London, UK
Worked in the TorchRL team on PyTorch and facebook-research open-source projects, leading to 2 publications [3, 7]
- Integrated multi-agent in the PyTorch reinforcement learning library *TorchRL* **(3.1k+ stars), becoming 2nd contributor**
- Developed and maintained *BenchMARL* **(464+ stars)**, a facebook-research multi-agent reinforcement learning library

Jun–Sep 2021 **Amazon, AWS**, *Software Development Engineer Intern*, Cambridge, UK
Worked in the EC2 team using Rust to implement an interactive serial console for Xen-based EC2 instances
- Learned and used the Rust language with cryptographic and asynchronous programming libraries
- Implemented an encrypted CoAP client-server and tested on docker rapid development environment

Teaching

2021–2025 **University of Cambridge**, *Guest lecturer, Teaching Assistant, and Supervisor*, Cambridge, UK
- *Guest lecturer* for the "Computing for Collective Intelligence" course , delivering a 1h lecture to master students
- *Teaching assistant*, demonstrator, and robot manager for "Introduction to Robotics" bachelor and master course
- *Thesis supervisor* for MPhil students, guiding them in conducting research and producing a master dissertation
- *Supervisor* and material curator for undergraduate courses, tutoring 19 students in small-sized groups

Organization

2024-present **The Alan Turing Institute**, *Organizer*, London
- Organized the UK Multi-Agent Systems Symposium, a day event in King's College **(200 attendees, 10k budget)**
- Managing the multi-agent systems interest group and mailing list with **650+ participants**

2023 **ICRA Workshop on Multi-Robot Learning** , *Contributions Committee*, London

Outreach

2024-25 **Lead The Future**, *Mentor*
Mentored 5 high-achieving STEM Italian students and professionals in a non-profit organization focused on *Give Back*

2023, 2024 **Computer Science Open Day**, *Volunteer*, University of Cambridge, UK
Demonstrated multi-robot reinforcement learning to **100+ kids** of all ages via live and interactive experiments

Awards and recognition

2024 Hughes Hall College (University of Cambridge) travel award - 500£
2021 Graduated with Distinction from the University of Cambridge
2017–2020 Achieved 30 Cum Laude/30 (Honors) for 13 of 25 exams at Politecnico di Milano and graduated Cum Laude
2017–2020 Merit-based scholarship at Politecnico di Milano - 50% tuition reduction

2017 Best Freshmen of Politecnico di Milano Award - 1500€

Skills

Programming Python, Java, Rust, C, JavaScript, VHDL *Systems* Linux, MacOS, ROS, SLURM, HPC, Docker
AI Libraries PyTorch, scikit-learn, NumPy, SciPy, TorchRL, TorchGeometric, TensorFlow, Pandas, matplotlib

Selected projects

- **BenchMARL**: created the facebook-research BenchMARL library **(464+ stars, 13k+ downloads)** to uniform benchmarking in multi-agent reinforcement learning, published at JMLR, presented at NeurIPS [3]
- **TorchRL**: second contributor of the PyTorch reinforcement learning library **(3.1k+ stars, 1M+ downloads)**, spanning multiple domains of data-driven decision-making (model-based/free, LLM RLHF, POMDPs) [7]
- **Vectorized multi-agent simulator (VMAS)**: implemented and maintained VMAS **(460+ stars, 50k+ downloads)**, a batched PyTorch multi-agent simulator and task collection for collective learning [6]
- **Multi-robot navigation**: deployed and demonstrated collective learning in a **zero-shot sim-to-real** setting on a fleet of custom Cambridge Robomaster holonomic ground robots equipped with NVIDIA Jetsons [10]

Publications

[1] **Matteo Bettini**. *Neural diversity in multi-agent learning* . PhD thesis, University of Cambridge, 2025.

[2] **Matteo Bettini**, Ryan Kortvelesy, and Amanda Prorok. Controlling Behavioral Diversity in Multi-Agent Reinforcement Learning . In *International Conference on Machine Learning (ICML)*, 2024.

[3] **Matteo Bettini**, Amanda Prorok, and Vincent Moens. BenchMARL: Benchmarking Multi-Agent Reinforcement Learning . *Journal of Machine Learning Research (JMLR)*, 25, 2024.

[4] **Matteo Bettini**, Ajay Shankar, and Amanda Prorok. System Neural Diversity: Measuring Behavioral Heterogeneity in Multi-Agent Learning . *Journal of Machine Learning Research (JMLR)*, 26, 2025.

[5] **Matteo Bettini**, Ajay Shankar, and Amanda Prorok. Heterogeneous Multi-Robot Reinforcement Learning . In *Autonomous Agents and Multiagent Systems (AAMAS)*, 2023.

[6] **Matteo Bettini**, Ryan Kortvelesy, Jan Blumenkamp, and Amanda Prorok. VMAS: A Vectorized Multi-Agent Simulator for Collective Robot Learning . In *Distributed Autonomous Robotic Systems (DARS)*, 2022.

[7] Albert Bou, **Matteo Bettini**, Sebastian Dittert, Vikash Kumar, Shagun Sodhani, Xiaomeng Yang, Gianni De Fabritiis, and Vincent Moens. TorchRL: A data-driven decision-making library for PyTorch . In *International Conference on Learning Representations (ICLR)* - ***Spotlight (top 5%)***, 2024.

[8] Amanda Prorok and **Matteo Bettini**. Heterogeneous Teams . *Encyclopedia of Robotics*, 2024.

[9] Steven Morad, Ryan Kortvelesy, **Matteo Bettini**, Stephan Liwicki, and Amanda Prorok. POPGym: Benchmarking Partially Observable Reinforcement Learning . In *International Conference on Learning Representations (ICLR)*, 2023.

[10] Jan Blumenkamp, Ajay Shankar, **Matteo Bettini**, Joshua Bird, and Amanda Prorok. The Cambridge RoboMaster: An Agile Multi-Robot Research Platform . In *Distributed Autonomous Robotic Systems (DARS)*, 2024.

[11] **Matteo Bettini**, Ryan Kortvelesy, and Amanda Prorok. The impact of behavioral diversity in multi-agent reinforcement learning . *arXiv preprint arXiv:2412.16244*, 2024.

[12] Pierre Andrews, Amine Benhalloum, Gerard Moreno-Torres Bertran, **Matteo Bettini**, Amar Budhiraja, Ricardo Silveira Cabral, Virginie Do, Romain Froger, Emilien Garreau, Jean-Baptiste Gaya, Hugo Laurençon, Maxime Lecanu, Kunal Malkan, Dheeraj Mekala, Pierre Ménard, Grégoire Mialon, Ulyana Piterbarg, Mikhail Plekhanov, Mathieu Rita, Andrey Rusakov, Thomas Scialom, Vladislav Vorotilov, Mengjue Wang, and Ian Yu. Are: Scaling up agent environments and evaluations . *arXiv preprint arXiv:2509.17158*, 2025.

[13] **Matteo Bettini***, Michael Amir*, and Amanda Prorok. When is diversity rewarded in cooperative multi-agent learning? . *arXiv preprint arXiv:2506.09434*, 2025. *shared first author.

[14] **Matteo Bettini** and Amanda Prorok. On the properties of path additions for traffic routing . *IEEE International Conference on Intelligent Transportation Systems (ITSC) Workshop on Co-Design and Coordination of Future Mobility Systems*, 2022.

Languages

English Full proficiency (*TOEFL IBT 112/120)* Italian Native

Invited talks

Controlling Behavioral Diversity in Multi-Agent Reinforcement Learning,

2025 ○ Laboratory for Artificial Intelligence and Learning Algorithms - *Università degli Studi di Milano*
2024 ○ Seminar on Combinatorics, Games and Optimisation - *London School of Economics and Political Science*
2024 ○ Artificial Intelligence Research Group Talks (Computer Laboratory) - *University of Cambridge*

BenchMARL: Benchmarking Multi-Agent Reinforcement Learning,

2024 ○ Distributed and Collaborative Intelligent Systems and Technology (DCIST) Collaborative Research Alliance (CRA)
2023 ○ InstaDeep knowledge sharing session - *InstaDeep*

Multi-Agent Simulation and Learning in TorchRL,

2023 ○ Artificial Intelligence Research Group Talks (Computer Laboratory) - *University of Cambridge*
2023 ○ Multi-agent Reinforcement Learning Reading Group - *University of Maryland, College Park*

Heterogeneous Multi-Robot Reinforcement Learning,

2022 ○ Distributed and Collaborative Intelligent Systems and Technology (DCIST) Collaborative Research Alliance (CRA)

Courses taught

2024-25 **Computing for Collective Intelligence** , *MPhil and Part III in Computer Science*, University of Cambridge
Delivered a 1h guest lecture and tutorial on simulation and training of multi-agent systems to 18 master students

2021-22, 2022-23 **Introduction to Robotics** , *MPhil, Part III, Part II in Computer Science*, University of Cambridge
Teaching assistant, grader, demonstrator, mini-project supervisor, and robot fleet manager

2021-22, 2022-23 **Concepts in Programming Languages** , *Part IB in Computer Science*, University of Cambridge
Creation & grading of personalized supervision sessions for 19 undergraduate students in groups of 2

Thesis supervision

2023 **Alex Shaw**, *MPhil in Machine Learning and Machine Intelligence*, University of Cambridge
Evaluating Benefits of Heterogeneity in Constrained Multi-Agent Learning

2023 **Sepand Dyanatkar**, *MPhil in Advanced Computer Science*, University of Cambridge
Resilience via Communication in Multi-Agent Reinforcement Learning

Reviewer duty

2025 Nature Communications, IROS
2024 CoRL, RA-L, Neurocomputing, Encyclopedia of Robotics, IROS, ARLET
2023 IROS, RA-L, ICRA, MRS, The International Journal of Robotics Research

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