Luca Grillotti

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I am a PhD student at the Adaptive and Intelligent Robotics Lab (AIRL) of Imperial College London under the supervision of Antoine Cully. I study how to leverage Reinforcement Learning and Quality-Diversity algorithms to learn a collection of diverse robotic skills in an unsupervised manner.

Education

2019-Now — Imperial College, London, England – PhD

PhD in **Evolutionary Robotic**s in the Adaptive and Intelligent Robotics Laboratory (AIRL). The research focuses on *autonomous discovery*, *optimization*, and exploitation of *behaviours* for *robotic systems*.

- Actively participate in the development of QDax, a *Python framework* to implement hardware-accelerated **Quality-Diversity** algorithms: github.com/adaptive-intelligent-robotics/QDax.
- Designed and maintain multiple design tools for all the members of the laboratory; those tools are used to easily *replicate* and *automate experiments* on High-Performance Computing facilities.

2016-17 — Imperial College, London, England – MSc (double-degree)

Master of Science (MSc) in Artificial Intelligence. Key subjects studied: *Machine Learning*, *Pattern Recognition*, *Reinforcement Learning*, *Robotics*, *Logic-Based Learning* and *Knowledge Representation*.

- Implemented a system capable of learning the rules and strategies of some board games by using **Python**, **Answer Set Programming,** and **Inductive Logic Programming**.
- During *robotics courses*, implemented a **particle filter** and a **Kalman filter** to localize respectively a moving robot and a drone.

2014-18 — Ecole Centrale Paris, France – MSc

Master's level engineering school. Key subjects studied: *Maths*, *Physics*, *algorithmic*, *programming*.

- Participated in the Eurobot qualifications in France in 2015 and 2016 as member of the CRoC (Centrale Robot Club). Programmed in **C++** on a **Raspberry Pi** to control and communicate with **Atmega** microcontrollers.
- Worked on year-long 5-person school team project to model the *propagation of bacteria* in cooling systems of nuclear plants by using **Matlab** – in collaboration with EDF, France.
- Created the circuit board and developed an **Arduino** program for a *hornet-killer* prototype in a group project.
- Participated in the design of *a synchrotron beamline*: intensive team project consisting of understanding and designing the different characteristics of a synchrotron beamline for an entire week.

2012-14 — Intensive preparation in Maths and Physics for the highly competitive entrance exams to the French Grandes Ecoles, Henri Poincaré School, Nancy, France

- Realized a presentation based on a year-long project about a mathematical study of the *game of Hex* and the theorems it implies (such as the *Brouwer Theorem* in the two-dimensional case).

2012 — Scientific Baccalaureate specializing in Maths and Physics (A)

Awards

Best Poster — Recognized for outstanding poster presentation at the semi-annual Imperial Computing Conference.

- Presented a summary of the research carried during the first two years of PhD in a poster entitled: *Autonomous Robots Realising their Abilities*.

Service and Community Management

Seminars

Co-organize the Imperial College Autonomous Learning and Reasoning (ICARL) monthly seminar.

- Each month, our department holds an on-campus event where we invite a Deep Reinforcement Learning researcher to present and discuss their research.
- Responsible for the setup of technical equipment, such as microphones and cameras in the lecture theatre, as well as editing videos for the YouTube channel.
- Website: icarl.doc.ic.ac.uk.

Reading Groups

Lead and manage the weekly reading group of the Adaptive and Intelligent Robotics Laboratory.

- The studied papers cover different topics related to **Quality-Diversity** and **Robot Learning**.

Attend and regularly present at the weekly Reinforcement Learning reading group.

- The presentations cover various aspects and applications of **Reinforcement Learning** such as: robot control, environment exploration, world modeling…

Conference Volunteering

Volunteer at the Genetic and Evolutionary Computation Conference (GECCO) in 2022 and 2023.

Teaching Activities

2019-Now — Imperial College, London, England – Teaching Scholar

Work for 315 hours per year on diverse teaching activities for the Department of Computing.

- Worked for 3 consecutive years as a Teaching Assistant for the **Reinforcement Learning** course; the teaching activities included: helping student during *tutorials* and *marking* assignments.
- Re-organized a **Computational Techniques** module: delivered *8 hours of lecture* in hybrid mode, wrote *detailed lecture notes*, designed *new sets of slides*, and managed the *organization of Tutorials*. Link to materials: https://bit.ly/comptech-2022.
- Provide a yearly lecture and designed materials for an "Introduction to Deep Learning with **PyTorch**" lesson. Link to materials: https://bit.ly/python-2022-deep-learning.
- Designed from scratch *5 assignments* for the **Python Programming** and **Probabilistic Inference** modules, including unit tests to automatically test and mark students' code. The evaluated topics include *Object-Oriented Programming*, *Gaussian Processes*, *Bayesian Optimization*, *Monte-Carlo Markov Chains* and *Variational Inference*.
- Conducted small-group mathematics tutorials for 4 consecutive years.

2020-22 — Imperial College, London, England – PGCert

Postgraduate Certificate (PGCert) in University Learning and Teaching. Key subjects studied: *approaches to teaching*, *how students learn*, *digital learning* and *educational supervision*.

- Restructured 50% of a mathematics module based on *research in teaching practices* and *digital learning*.

2016-18 — Private Tutoring

Gave *private lessons* in mathematics, physics and computer science to several high school and middle school students.

Educational Supervision

Master of Science

- H. Janmohamed (2022) – Distractor-Aware Unsupervised Discovery of Abilities.

Master of Engineering

- V. Ho (2022-2023) – Exploring Different Encoding Methods for Unsupervised Behavioural Discovery.
- W. Profit (2021-2022) – Combining Deep Reinforcement Learning and Quality-Diversity Algorithms.
- M. Xu (2020-2021) – World Modelling through Quality-Diversity Algorithms.

Professional Experience

2018-2019 Alten – External service provider at Edvance, Paris, France

Contribute to the development of DEDALE: a software written in **Python** for routing cables in plants in an optimized manner.

- Worked on the **Genetic Algorithm** used for optimizing the cable paths: improved the weight distribution in cable trays.
- Composed *specifications* detailing the new functionalities of DEDALE.
- Participated in the writing of a *conference paper* detailing the functionalities of the software and how it works.

2017-2018 AI Lab, SoftBank Robotics Europe, Paris, France – Intern

Work on *morphology optimization* for simulated robot (in **MuJoCo** or **Bullet**) to solve a task, by using **Evolution Strategies** (CMA-ES) or **Bayesian Optimization**.

- For each robot morphology, a **Reinforcement Learning** algorithm (*Proximal Policy Optimization*) was used to optimize a controller in the simulated environment.
- Participated actively and presented several papers at the weekly *reading group*.

Languages and Communication Skills

French Mother tongue

English Full professional proficiency

- Have been living in London for 5 years.
- IELTS score (March 2016): 7.5

Computer and Robotics Skills

Software	Git, Container platforms (daily usage of Singularity, basic knowledge of Docker), Matlab, Maple.
Languages	Python, C++, SQL, Java, Prolog, Caml, LaTeX, Answer Set Programming (Clingo).
Libraries	*Python* : JAX, Torch, Flax, GPy(Opt), NetworkX, Numpy, Matplotlib, Pandas. *C++* : Boost, Eigen, libtorch.
Simulators	Brax, IsaacGym, DART, Bullet.
Electronics	Programming on Arduino, use of Altium and KiCad to create circuit boards.
Design	Elementary usage of Inkscape (diagram design), Adobe Premiere Pro (seminar video editing) and Adobe InDesign (poster design).

Extracurricular Activities

Teamwork	Formerly Involved in VIA, society that provides Internet in the student residences and solves students' problems during *office hours*. Former Vice-President of LUDiC, society that organizes board, strategy, and role-playing games events; oversaw a chess tournament with other Grandes Écoles in the Paris area.
Music	Play regularly *piano* and *guitar*, played in a band for 4 years.
Chess	Actively play chess and enjoy strategic problem-solving. Member of local chess club.

Reviewer and Program Committee Member

Conference and Workshops	Main Theme of the Conference	Year	Role
GECCO Conference	Artificial Evolution	2023	Program Committee
GECCO Evolutionary Reinforcement Learning Workshop	Artificial Evolution	2022	Reviewer
ICLR Workshop on Agent Learning in Open-Endedness	Representation Learning	2022	Reviewer
ICRA	Robotics	2022	Reviewer
IROS	Robotics	2021	Reviewer
ALife	Artificial Life	2020	Reviewer

Publications

Key Statistics

Publications in peer-reviewed international journals	1
Publications in peer-reviewed international conferences	4
Total citations (Google Scholar, raw number)	74

Journal Papers (Peer-reviewed)

- Grillotti, L. and Cully, A., 2022. Unsupervised Behavior Discovery with Quality-Diversity Optimization. *IEEE Transactions on Evolutionary Computation*, *26*(6), pp.1539-1552.

Conference Papers (Peer-reviewed)

- Grillotti, L.*, Flageat, M.*, Lim, B. and Cully, A., 2023, July. Don't Bet on Luck Alone: Enhancing Behavioral Reproducibility of Quality-Diversity Solutions in Uncertain Domains. In *Proceedings of the Genetic and Evolutionary Computation Conference*.
- Lim, B., Allard, M., Grillotti, L. and Cully, A., 2022. Accelerated Quality-Diversity through Massive Parallelism. *Transactions on Machine Learning Research*.
- Lim, B., Grillotti, L., Bernasconi, L. and Cully, A., 2022, May. Dynamics-aware quality-diversity for efficient learning of skill repertoires. In *2022 International Conference on Robotics and Automation (ICRA)* (pp. 5360-5366). IEEE.
- Grillotti, L. and Cully, A., 2022, July. Relevance-guided unsupervised discovery of abilities with quality-diversity algorithms. In *Proceedings of the Genetic and Evolutionary Computation Conference* (pp. 77-85).

Workshop Papers (Peer-reviewed)

- Grillotti, L. and Cully, A., 2023. Kheperax: a Lightweight JAX-based Robot Control Environment for Benchmarking Quality-Diversity Algorithms. In *GECCO Workshop on Benchmarks for Quality-Diversity algorithms*.
- Flageat, M., Grillotti, L. and Cully, A., 2023. Benchmark Tasks for Quality-Diversity Applied to Uncertain Domains. In *GECCO Workshop on Benchmarks for Quality-Diversity algorithms*.
- Flageat, M., Lim, B., Grillotti, L., Allard, M., Smith, S.C. and Cully, A., 2022. Benchmarking Quality-Diversity Algorithms on Neuroevolution for Reinforcement Learning. In *GECCO Workshop on Benchmarks for Quality-Diversity algorithms*.
- Lim, B., Allard, M., Grillotti, L. and Cully, A., 2022. Accelerated quality-diversity for robotics through massive parallelism. In *ICLR Workshop on Agent Learning in Open-Endedness*.
- Grillotti, L. and Cully, A., 2022. Discovering Unsupervised Behaviours from Full State Trajectories. In *ICLR Workshop on Agent Learning in Open-Endedness*.