Louis Berthier

PhD candidate experienced in ML, Mathematics, and Programming.
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Education

Ecole Polytechnique | PhD in Applied Mathematics & Machine Learning *Mar 2024 - Present*
Paris, France

- Industrial Thesis (CIFRE) in collaboration with Michelin, supervised by Pr. Eric Moulines, & Dr. Ahmed Shokry.
- Developing predictive algorithms for real-time quality monitoring in industrial processes using conformal and adaptive soft sensors.

Imperial College London | MSc Advanced Computing in Machine Learning *Oct 2022 - Oct 2023*
London, United Kingdom

- Thesis under the supervision of Pr. Antoine Cully: model-based uncertainty quantification for quality-diversity optimisation.
- Diploma with merit (2:1), and thesis with distinction (1st).
- Relevant Modules: Machine & Deep Learning, Reinforcement Learning, Computer Vision, NLP, Mathematics for ML, Computational Finance, Robot Learning.

IMT Mines Alès | MSc AI & Data Science (Diplôme d'Ingénieur) *Sep 2020 - Sep 2023*
Alès, France

- Average grade (GPA): 3.7/4 with first class honours and jury's congratulations.
- Ranked 2^{nd} in CS & AI dept. (of 56) and top 5% of class.
- Relevant Modules: Advanced Probabilities & Statistics, Operational Research, Algorithms & Complexity, Machine & Deep Learning, Software Engineering.

Lycée Déodat de Séverac | Scientific Preparatory Classes *Sep 2018 - Sep 2020*
Toulouse, France

- Intensive two-year program in mathematics, physics, and computer science, preparing for national competitive exams for top French engineering schools.

Work Experience

Augmodo | Research Scientist (Part-Time) *Aug 2025 - Present*
Kirkland, Washington, United States
Uncertainty quantification and reliability enhancement of computer vision pipelines for industrial applications in retail. In collaboration with Sacha Hu (Senior Research Scientist).

- Developing uncertainty-aware computer vision models to improve robustness in real-world deployments.
- Collaborating on end-to-end pipeline development for deployment in retail environments.

Michelin | Research Engineer (PhD Contract) *Mar 2024 - Present*
Clermont-Ferrand, France
Conformal and adaptive soft sensors for rubber production line quality monitoring.
Supervised by Guillaume Ramelet (Principal Data Scientist), Dr. Maxime Moreaud (Principal Data Scientist), & Dr. Sylvain Desroziers (R&D Manager).

- Proposed a data-driven framework relying on novel feature selection, explainability and rigorous uncertainty quantification for offline batches quality prediction.
- Developed TorchSOM package for scalable and efficient self-organizing maps with user friendly visualizations.
- Designed online strategies for quality monitoring and process control.
- Implemented online uncertainty quantification tools to ensure reliability.

Adaptive & Intelligent Robotics Lab (AIRL) | Research Assistant *Apr 2023 - Sep 2023*
London, United Kingdom
Model-based uncertainty quantification for quality-diversity optimisation.
Supervised by Pr. Antoine Cully (AIRL director), Manon Flageat, & Bryan Lim (AIRL PhD candidates) at Imperial College London.

- Improved the data efficiency and noise robustness of MAP-Elites by developing a novel model-based implementation, enhancing performance in uncertain environments.

- Introduced new hyperparameters to bridge the gap between model-based and model-free Quality-Diversity (QD) algorithms, allowing for more flexible and powerful solutions.
- Developed new metrics to better assess uncertainty quantification in QD algorithms, providing deeper insights into model performance and reliability.

Centre National de la Recherche Scientifique (CNRS) | Research Intern *May 2022 - Jul 2022*

Toulouse, France

Detection of pathological oscillations in epilepsy using signal processing and convolutional neural networks. Supervised by Dr. Ludovic Gardy (CNRS research engineer), Pr. Emmanuel Barbeau (CNRS research director), & Pr. Christophe Hurter (ENAC research professor).

- Accelerated signal and image processing pipelines by 15% through Cython optimization for faster analysis of pathological oscillations in epilepsy.
- Engineered 7 NoSQL databases to manage and analyze large-scale EEG data at both macro and micro scales, improving data accessibility and query performance.
- Enhanced classification model performance by 5% through systematic fine-tuning and hyperparameter optimization.
- Leveraged Grad-CAM to improve model explainability, ensuring predictions aligned with underlying neurophysiological biomarkers.

EuroMov DHM | Research Assistant *Jan 2022 - Apr 2022*

Alès, France

Design of an image filter for narrow contour detection and multi-scale adaptation using machine learning. Supervised by Pr. Baptiste Magnier & Pr. Binbin Xu, research-professors at IMT Mines Alès

- Developed a novel 2D filter for detecting adjacent and multi-scale ridges in images, leading to a publication in IEEE ICASSP 2023.
- Implemented and benchmarked state-of-the-art edge detection models (e.g., DexiNed, RCF) as part of a comparative analysis for contour detection.

Skills

Programming Languages: Python, SQL/NoSQL, LaTeX, Cython

ML Frameworks: PyTorch, JAX, TensorFlow, NumPy, Pandas, Scikit-learn, OpenCV, SciPy, Pytest, Triton

Developer Tools & MLOps: Git, Docker, Azure ML, Kubernetes, Weights & Biases, Singularity, SkyPilot, CI/CD

Languages: French (Native), English (Fluent), Spanish (Professional Proficient)

Presentations

Research Seminar Founder & Organizer | Michelin *Apr 2024 - Present*

Clermont-Ferrand, France

- Founded and organized a bi-monthly research seminar for researchers and data scientists to present and discuss key papers in ML, CV, NLP, and Uncertainty Quantification.
- My presentations focused on: Attention Is All You Need, Quality-Diversity Optimization, HyenaDNA, Conformal Prediction, and TorchSOM.

Talks *July 2025 - Present*

Worldwide

- **ESCAPE 35th**, Ghent, Belgium. *Knowledge Discovery in Large-Scale Batch Processes through Explainable Boosted Models and Uncertainty Quantification: Application to Rubber Mixing*
- **Michelin Data Scientists Network**, Clermont-Ferrand, France. *Online Sensing for Quality Monitoring*

Poster Presentations *Apr 2024 - Present*

Worldwide

- **Welcome Day IP Paris**, Paris, France. *Knowledge Discovery in Large-Scale Batch Processes*, Awarded Best PhD Poster in Mathematics
- **Michelin Doctoral Day**, Clermont-Ferrand, France. *A Framework for Knowledge Discovery in Rubber Mixing Processes*

MT180 Finalist & Public Award | École Polytechnique *Feb 2025 - Apr 2025*

Palaiseau, France

- Selected as a finalist and recipient of the Public Award in the national "Ma Thèse en 180 secondes" (MT180) competition, challenging PhD students to present their research to a broad audience in 180 seconds.
- My talk: *Robust real-time quality monitoring and reliable adaptation of manufacturing processes in the tire industry*, highlighting the impact of machine learning and uncertainty quantification for industrial process optimization.
- Chosen from 25 participants; advanced to the national finals and recognized for excellence in public engagement.
- Resources: Video Presentation | Finalists Announcement | Awards Coverage

Teaching

Teacher Assistant | ENSTA Paris *Sep 2024 - Oct 2025*

Paris, France

- Co-instructed an introductory course on machine learning and data science through lab sessions for 3rd year BSc mathematics students (20h/year, two consecutive years).

Rewards

Honours

- **Master Thesis with Distinction (1st)** | Imperial College London, 2023
  Proposal for a PhD in the AIRL laboratory under the supervision of Pr. Antoine Cully.
- **Master of Science with Merit (2:1)** | Imperial College London, 2023
- **Diplôme d'ingénieur with First Class Honours (1st)** | IMT Mines Alès, 2023
  Jury's congratulations, ranked 2^{nd} in the CS & AI department, and in the top 5% of all students.
- **French Scientific Baccalaureate with High Honors** | Lycée Saint-Exupéry, 2018
  Highschool project selected for the Engineering Sciences Olympiad.

Grants & Academic Awards

- **MT180 Public Award (€100)** | Institut Polytechnique de Paris, 2025
- **Best PhD Poster Award (€500)** | Institut Polytechnique de Paris, 2024
- **International Mobility Scholarship (€4000)** | Région Occitanie, 2022
- **Alumni Scholarship (€1300)** | Mines Alès Alumni, 2022
- **Excellence Scholarship (€4000)** | IMT Mines Alès, 2022

Competitions & Hackathons

- **Winner, Manufacturing IT Hackathon AI'NNOV (€500)** | Michelin, 2024
- **Creativity Laureate, Communication & Media (€80)** | Cora Hypermarket, 2021

Volunteering

University Handball | Team Player *Sep 2020 - Nov 2023*

France & UK

- Achieved 3^{rd} place in the highest national university league (BUCS, UK).
- Achieved 4^{th} place in the highest national university league (FFSU, France).
- Winner of the 49^{th} Challenge Centrale Lyon
- Winner of the 19^{th} TRAMS

Bureau des Sports (Sports Association) | Vice President *Feb 2021 - Apr 2022*

Alès, France

- Led a 25-person team to manage 5 tournaments and oversee 20 sports.
- Secured partnerships with major brands, including Armor Lux and Tony Parker.
- Managed the association's website and IT infrastructure.

EmaVisual (Photography & Video Association) | Vice President *Apr 2021 - Apr 2022*

Alès, France

- Led a team of 10 photographers to cover 25 university events.
- Edited and produced multiple videos and over 10,000 photos.

Tsiky Zanaka (Humanitarian Association) | Volunteer *Sep 2020 - Sep 2021*

Alès, France

- Raised over €3500 to fund and support solidarity projects in Madagascar.

- Organized and participated in fundraising events, including cooking for 300 students.

EmaMix (DJs Association) | Disc Jockey *Sep 2020 - Sep 2021*
Alès, France

- Provided music and technical support for student events and gatherings.

Trophée Orlandini (Rugby Tournament Association) | Logistics Volunteer *Sep 2020 - Oct 2020*
Alès, France

- Prepared event logistics and setup for a multi-school rugby tournament.

Modelling Contest | Socute Models *2019 - 2020*
Toulouse, France

- Twice finalist in a male modelling contest.

Publications

[1] L. Berthier, A. Shokry, E. Moulines, S. Desroziers, and G. Ramelet. "Robust and Reliable Data-Driven Framework for Quality-Related Knowledge Discovery in Large-Scale Rubber Mixing Batch Processes". In: *Chemometrics and Intelligent Laboratory Systems* (2025). To be submitted.

[2] Louis Berthier. *torchsom: The Reference PyTorch Library for Self-Organizing Maps*. Version 1.1.1. Documentation available at https://opensource.michelin.io/TorchSOM/. 2025. URL: https://github.com/michelin/TorchSOM.

[3] Louis Berthier, Ahmed Shokry, Maxime Moreaud, Guillaume Ramelet, and Eric Moulines. *torchsom: The Reference PyTorch Library for Self-Organizing Maps*. Preprint submitted to Journal of Machine Learning Research. 2025. arXiv: 2510.11147 [stat.ML]. URL: https://arxiv.org/abs/2510.11147.

[4] Louis Berthier, Ahmed Shokry, Eric Moulines, Guillaume Ramelet, and Sylvain Desroziers. "A Framework for Knowledge Discovery in Rubber Mixing Processes through Explainable Boosted Models and Uncertainty Quantification". In: *ESCAPE 2025*. 2025. DOI: 10.69997/sct.183525. URL: https://psecommunity.org/LAPSE:2025.0396.

[5] Ludovic Gardy, Jonathan Curot, Luc Valton, Louis Berthier, Emmanuel J. Barbeau, and Christophe Hurter. "Detecting fast-ripples on both micro- and macro-electrodes in epilepsy: A wavelet-based CNN detector". In: *Journal of Neuroscience Methods* 415 (2025), p. 110350. ISSN: 0165-0270. DOI: https://doi.org/10.1016/j.jneumeth.2024.110350. URL: https://www.sciencedirect.com/science/article/pii/S0165027024002954.

[6] Baptiste Magnier, Ghulam Sakhi Shokouh, Louis Berthier, Marcel Pie, and Adrien Ruggiero. "2DSBG: A 2d Semi Bi-Gaussian Filter Adapted for Adjacent and Multi-Scale Line Feature Detection". In: *ICASSP 2023 - 2023 IEEE International Conference on Acoustics, Speech and Signal Processing (ICASSP)*. 2023, pp. 1–5. DOI: 10.1109/ICASSP49357.2023.10095570.