

# LOUIS BERTHIER

MSc student experienced in ML, Mathematics and Programming looking for a PhD position starting in Spring 2024.

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## EDUCATION

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### Imperial College London | MSc Computing AI & ML

October 2022 - October 2023

London, United Kingdom

- Thesis: Model-Based Uncertainty Quantification for Quality-Diversity Optimisation. Supervisor: Dr. Antoine Cully.
- Diploma with Merit (2:1), and Thesis with Distinction (1st).
- Modules: Machine Learning, Deep Learning, Reinforcement Learning, Computer Vision, Natural Language Processing, Independent Study Option, Mathematics for Machine Learning, Computational Finance, Robot Learning, Machine Learning for Imaging, Principles of Distributed Ledgers.

### IMT Mines Alès | Diplôme d'ingénieur - MSc Computing AI & DS

September 2020 - September 2023

Alès, France

- Average final result (GPA): 3.67/4, First Class Honours.
- Ranked 2<sup>nd</sup> in the Computer Science & AI department among 56 students, and in the top 5% among 258 students.
- Relevant Modules: Machine Learning, Advanced Probabilities & Statistics, Operational Research, Algorithms & Complexity, Time Series, Computer Vision, Image & Signal Processing, Software Engineering, Calculus & Numerical Analysis.

### Lycée Déodat de Séverac | Scientific Preparatory Classes - PCSI/PSI\*

September 2018 - July 2020

Toulouse, France

- Completed intensive and advanced courses in Mathematics, Physics and Computer Science.

## RESEARCH & WORK EXPERIENCE

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### Adaptive & Intelligent Robotics Lab (AIRL) | Research Thesis

April 2023 - September 2023

London, United Kingdom

Supervisors: Dr Antoine Cully, Director of the AIRL at Imperial College London & Manon Flageat and Bryan Lim, two PhD candidates at the AIRL.

- Implemented a model-based version MAP-Elites to improve its data efficiency and its robustness against noise.
- Contributed to the development of the QDax library, adding new features such as (1) MBQD algorithms, (2) the use of a buffer and (3) modification of the scoring function of the redundant simulated robotic arm.
- Proposed multiple analyses of both the behaviour of the algorithms and that of each model.
- Introduced new hyperparameters to bridge the gap between model-based and model-free QD algorithms, and new metrics to assess uncertainty quantification.
- Demonstrated the importance of 3 mechanisms in a non-deterministic environment, namely the use of (1) a probabilistic model, (2) an explicit sampling approach and (3) container reset.

### Centre National de la Recherche Scientifique (CNRS) | Research Intern

May 2022 - July 2022

Toulouse, France

Supervisors: Dr Ludovic Gardy, Research Engineer in Computational Neuroscience at CNRS & Dr Emmanuel Barbeau, Director of Research at CNRS & Dr Christophe Hurter, Research Professor in Information Visualization at Ecole Nationale de l'Aviation Civile (ENAC).

- Optimized signal and image processing methods, reducing computation time by 15% using the Cython library.
- Built 7 NoSQL databases for analyzing EEG data at macro and micro scales.
- Improved model performance by 5% through fine-tuning techniques.
- Implemented Grad-CAM to enhance model explainability and alignment with underlying data.
- Evaluated model resilience and generalization to multiple biomarkers.
- Submitted an article to the Journal of Neuroscience Methods for peer review.

### EuroMov Digital Health in Motion (DHM) - IMT Mines Alès | Research Intern

January 2022 - April 2022

Alès, France

Supervisors: Dr Baptiste Magnier, Research Professor in Computer Vision at IMT Mines Alès & Dr Binbin Xu, Research Professor in Algorithms and Complexity at IMT Mines Alès.

- Developed a novel 2D filter for detecting adjacent and multi-scale ridges in images.
- Implemented state-of-the-art edge detection models (DexiNed, RCF) within images.
- Submitted an article, published in IEEE ICASSP. Available [here](#).

### Smile Rain | Strategy & Economic Consultant

May 2021 - June 2021

Alès, France

- Led a team of 3 consultants to identify the 50 most promising countries through an MCDA of 18 factors.
- Forecasted the company's financial performance and prepared comprehensive 3-year financial statements, including income statement, cash flow, and balance sheet.

## PROJECTS

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- Model-Based Approaches for Uncertainty Quantification** | *Research Project* *January 2023 - April 2023*
- Explored the impact of uncertainty on QD algorithms and investigated techniques for handling and quantifying uncertainty.
  - Implemented and thoroughly evaluated various QD algorithms, particularly focusing on MAP-Elites, in both deterministic and uncertain environments.
- Agent Control & Uncertain Environments** | *Research Project* *January 2023 - March 2023*
- Developed advanced learning methods by integrating MBRL approaches into existing techniques like RS and CEM to tackle challenging and noisy environments.
  - Implemented strategies to optimize agent movement and design novel reward functions for enhanced learning.
- Generative Models** | *Research Project* *January 2023 - March 2023*
- Implemented VAE and GAN architectures to generate and reconstruct images across diverse domains.
  - Conducted comprehensive visual evaluations to assess the fidelity and realism of the generated images from both models.
  - Performed in-depth theoretical and mathematical analyses of VAE and GAN frameworks, elucidating their underlying principles and highlighting their strengths and limitations.
- Patronizing Classification** | *Research Project* *January 2023 - March 2023*
- Utilized the Don't Patronize Me! dataset to accurately identify and categorize instances of Patronizing Classification (PCL).
  - Implemented techniques such as data augmentation, optimized pre-processing methods, and extensive hyperparameter studies to enhance the performance of the RoBERTa model for PCL.
  - Conducted a comprehensive comparative analysis, evaluating the RoBERTa model against various baseline approaches to assess its effectiveness in PCL tasks.
- Time Series Forecasting - Energy Consumption** | *Personal Project* *December 2022 - January 2023*
- Utilized XGBoost to predict energy consumption, enabling proactive resource planning and decision-making.
  - Implemented outlier removal and time series cross-validation to improve the accuracy and robustness of the model.
  - Leveraged lag features and analyzed feature importance to capture historical patterns and identify key drivers impacting energy consumption, enhancing understanding and enabling strategic insights.
- Deep Q Networks** | *Research Project* *October 2022 - December 2022*
- Implemented and transformed a DQN into a DDQN using OpenAI Gym and Maze environment.
  - Conducted a comprehensive investigation and comparative analysis of various RL methods, such as DP, MC, and TD, to enhance the learning process while striking an optimal balance between exploration and exploitation.
- Portfolio Optimization - FAANG** | *Personal Project* *September 2022 - November 2022*
- Developed a portfolio optimization system to create efficient portfolios with optimized risk-return trade-offs.
  - Constructed diversified portfolios by selecting assets and assigning appropriate weights based on historical performance.
  - Implemented volatility and variance calculations to measure risk and evaluated the efficiency of portfolios using performance metrics such as Sharpe ratio and maximum drawdown.
- Time Series Forecasting - Jobs & Industries** | *Personal project* *March 2022 - April 2022*
- Employed statistical analysis, seasonality, and trend to accurately predict the evolution and behaviour of time series data within employment contracts and diverse industry sectors.
  - Implemented and compared several forecasting models such as SES, Holt Winter, ARIMA, and SARIMA.
- Brain Tumors Classification** | *Personal project* *February 2022 - April 2022*
- Implemented a CNN architecture to classify the presence of brain tumours in MRI images accurately.
  - Employed data augmentation techniques, optimized pre-processing methods, and conducted rigorous hyperparameter studies to enhance the performance of the model.
- Kalman Filter** | *Personal project* *October 2021 - December 2021*
- Implemented and applied the Kalman filter algorithm to analyze the movement patterns of individuals using MOT databases and bee videos.
  - Enhanced performance and reliability of motion prediction by integrating image background pre-processing techniques with the Kalman filter.

## LANGUAGE & TECHNICAL SKILLS

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- French (native), English (fluent, C1, Duolingo English Test: 130/160), Spanish (business proficient, B1/B2)
- Python (main language), (No)SQL, C, MATLAB, R, Java, HTML, CSS, Microsoft Suite, Git, LaTeX, Singularity, Docker, Weights & Biases
- NumPy, Pandas, TensorFlow, PyTorch, JAX, QDax, OpenCV, Scikit-learn, Matplotlib, SciPy, Seaborn
- Adobe Lightroom, Adobe Premiere Pro, Adobe After Effects

**Articles**

\*: first authors

*Journal of Neuroscience Methods*, *Detecting fast-ripples on both micro- and macro-electrodes in epilepsy: a Fourier Analysis-based Scalogram based detector (FAST)*.

Submitted for peer review.

Ludovic Gardy\*, Emmanuel J. Barbeau, Jonathan Curot, Luc Valton, Christophe Hurter and Louis Berthier

*IEEE ICASSP*, *2DSBG: A 2D Semi Bi-Gaussian Filter Adapted for Adjacent and Multi-Scale Line Feature Detection*.

**Published.**

Baptiste Magnier, Ghulam Sakhi Shokouh, Louis Berthier, Marcel Pie and Adrien Ruggiero

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**ACADEMIC HONOURS, SCHOLARSHIPS & COMPETITIONS**

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**Academic Perspective**

2018 - 2023

- Master Thesis with Distinction (1st) | Imperial College London, 2023
- Master of Science with Merit (2:1) | Imperial College London, 2023
- Diplôme d'ingénieur with First Class Honours | IMT Mines Alès, 2023
- Scholarship for international mobility and my double degree project with Imperial (4000€) | Région Occitanie, 2022
- Alumni scholarship for my double degree project with Imperial (1300€) | Mines Alès Alumni 2022
- Scholarship of excellence (4000€) | IMT Mines Alès, 2022
- Letter of congratulations from the jury for my excellent results | IMT Mines Alès, 2022
- Creativity Laureate after reinventing and organizing the communication and media | Cora Hypermarket, 2021
- French Scientific Baccalaureate obtained with High Honors | Lycée Saint-Exupéry, 2018
- Highschool project selected for the Engineering Sciences Olympiad | Lycée Saint-Exupéry, 2018

**Sports Perspective**

2019 - 2023

- 3<sup>rd</sup> position in the highest national league (Handball) | British Universities and Colleges Sport, 2023
- 4<sup>th</sup> position in the highest national league (Handball) | Fédération Française du Sport Universitaire, 2022
- Winner of the 49<sup>th</sup> edition of the Challenge Centrale Lyon (Handball) | Centrale Lyon, 2022
- Winner of the 19<sup>th</sup> edition of the TRAMS (Handball) | ENTPE, 2021
- Male modelling competition finalist | Socute Models, 2019 & 2020

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**VOLUNTARY EXPERIENCE**

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**Bureau des Sports (Sports Association) | Vice President**

February 2021 - April 2022

Alès, France

- Led a team of 25 people to manage 5 tournaments, 20 sports, and 50 captains-coaches.
- Secured many partners to support us, including Armor Lux and Tony Parker.
- Supervised and updated the IT part of the website.
- Planned meetings with several stakeholders to ensure the progress of projects.

**EmaVisual (Photography & Video Association) | Vice President**

April 2021 - April 2022

Alès, France

- Led a team of 10 photographers to cover 25 association events.
- Edited multiple videos and about 10000 photos.
- Planned meetings with several stakeholders to ensure the progress of projects.

**Tsiky Zanaka (International Humanitarian Association) | Volunteer**

September 2020 - September 2021

Alès, France

- Cooked meals for 300 students on several evenings and raised 3500€ with 30 other students through activities.
- Participated in the development of several solidarity projects in Madagascar.

**EmaMix (DJs Association) | Disc Jockey**

September 2020 - September 2021

Alès, France

- Animated the student life by mixing at meals, parties, and student events.

**Trophée Orlandini (Rugby Tournament Association) | Logistics Volunteer**

September 2020 - October 2020

Alès, France

- Participated in the logistic organization and the progress of the tournament gathering 6 schools on a weekend.