Pierre-Louis Lemaire

Polytechnique Montréal A-520.19 438-238-5571
pierre-louis.lemaire@polymtl.ca linkedin.com/in/pierrelouislemaire pierrelouislemaire.github.io

Education

Polytechnique Montréal Expected December 2025
Research M.Sc. in Applied Mathematics (GPA: 4.00 / 4.00) *Montréal, Canada*

- **Research project:** I work on implementing and proposing machine learning approaches for climate downscaling. Specifically, I am interested in projects related to probabilistic modeling and physics-informed ML.
- **Course work:**
  - MTH-1115D - Differential Equations (grade: A)
  - MTH-6420 - Continuous Optimization (grade: A*)
  - MTH-8107 - Mathematics of Deep Learning (grade: A*)
  - MTH-8245E - Machine Learning (grade: A)
  - (MILA) IFT-6135 - Representation Learning (grade: A+)
  - (MILA) IFT-6168 - Causal Inference & ML (grade: A+)
  - (ETS) TSMGC921 - Climate Science Summer School (grade: A+)

INSA Toulouse Expected December 2025
Engineering Diploma in Applied Mathematics *Toulouse, France*

- **Double degree** program in partnership with Polytechnique Montréal.
- **Relevant coursework:** Statistical Modeling, Machine Learning, Data Analysis, Continuous Optimization, Non-Differential Optimization, Signal Processing, Advanced Probability, Markov Chains - Python, R & Git

Experience

MILA September 2024 – January 2025
Teaching Assistant, IFT6135 Representation Learning (54 students) *Montréal, Canada*

- I created and graded intensive theoretical and practical assignments on deep learning (CNN, UNet, GANs, diffusion models). I contributed to the final exam's questions bank on GANs and graded exams.
- I held 2 office hours per week to help students with assignments.
- I gave an introduction to Pytorch tutorial.

Acsystème June 2023 – August 2023
Optimization Engineer Intern *Rennes, France*

- I conducted a literature review on the 3D Knapsack problem, to design a combinatorial optimization algorithm for truck palletization.
- I designed and implemented a program in MATLAB that increased items by pallet by 40% while being 20x faster to compute.

Coolset June 2022 – August 2022
Data Analyst Intern *Amsterdam, Netherlands*

- I updated the emission factor database and automated data pipelines using web scraping.
- I improved by 45% the accuracy of the ML classifier of carbon emission factors for financial transactions.

Synergiz June 2020 – August 2020
Computer Vision Intern *Saint-Malo, France*

- I developed a C# program aiming to accelerate image labeling to train an Azure AI Custom Vision object detector for an agricultural application.
- I integrated the ML model into a Windows application with .NET.

Hackathons & Volunteering

CodeML - PolyAI — **WINNER** 2024
2 days to develop ML models for better flood modeling — *Montréal, Canada*

Montréal AI Symposium SIAM — October 2024
Volunteer — *Montréal, Canada*

AMS 105th Annual Meeting — January - 2025
Selected for the Student Assistant program (Scolarship) — *New Orleans, USA*

Projects

Multivariate Downscaling over Southern Quebec using a Probabilistic UNet — 10th Ouranos Symposium

- Accepted and presented as a poster.
- We proposed of a probabilistic UNet model for multivariate climate downscaling. We presented of results demonstrating the improved performance of the probabilistic approach. We performed downscaling of climate simulations from a CRCM5 ensemble (ClimEx) by downscaling factor of 16.

On the necessity of human insight to improve natural adversarial robustness | *IFT-6168* — grade: 97/100

- We investigated adversarial attacks from a causal perspective and reproduced a causally inspired adversarial training method with PyTorch.
- We proposed and implemented a style-free contrastive regularization method with PyTorch to improve natural adversarial robustness.
- We compared distribution alignment methods and vanilla learning with natural adversarial augmentations on natural adversarial robustness. We found that the proportion of natural adversarial samples per batch plays an important role in the model's robustness.

Data analysis of Paris bike-sharing service | *Python, Scikit-learn, R*

- I implemented (in Python and R) dimensionality reduction algorithms (PCA, LDA), clustering methods (kmeans, HAC, GMM) and advanced factorial methods (CA, MCA, MDS, NMF).
- I provided in-depth interpretation and analysis of the results of all the above methods.

Skills & Hobbies

Languages: French: Native — English: TOEIC (score: 990/990 in 2023) - TOEFL (score: 100/120 in 2019);

Developer Toolbox: Git, Pytorch, Scikit-Learn, Xarray, Dask, VScode, Bash scripting;

Programming Languages: Python, R, Matlab;

Hobbies: Sailing, Reading, Skiing.

References

Julie Carreau — Assistant Professor
MSc main supervisor — julie.carreau@polymtl.ca — *Polytechnique Montréal*

Youssef Diouane — Associate Professor
MSc co-supervisor — youssef.diouane@polymtl.ca — *Polytechnique Montréal*

Aishwarya Agrawal — Assistant Professor — Research Scientist
TA supervisor for IFT6135 — aishwarya.agrawal@mila.quebec — *Université de Montréal — Google Deepmind*