Pierre-Louis Lemaire

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Education

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

- **Research project:** Physics-informed machine learning for regional climate model emulation. I work on implementing a physics-informed approach for climate downscaling, using PINNs and governing laws from atmospheric physics.
- **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*

- **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 2024
Teaching Assistant, IFT6135 Representation Learning (54 students) *Montréal, Canada*

- I create and grade intensive theoretical and practical assignments. I also contribute to the final exam question bank.
- I hold bi-weekly office hours. I gave a tutorial on PyTorch to help the students solve the practical assignments.

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 ensured carbon emission forecasts were accurate and improved the in-house ML classifier.

Synergiz June 2020 – August 2020
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. Later on, I integrated the model into a Windows application with .NET.

Hackathons & Support

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

Montréal AI Symposium SIAM 2024
Volunteer *Montréal, Canada*

AMS 105th Annual Meeting Upcoming - 2025
Student Assistant program *New Orleans, USA*

Projects

Probabilistic Deep Convolutional Net for Multivariate Statistical Downscaling Poster at 10th Ouranos Symposium

- Accepted and will be presented in January 2025.
- We proposed a probabilistic UNet architecture for the task of multivariate climate downscaling. We jointly downscaled precipitation and temperature using simulations from a large RCM ensemble over Quebec.
- We showed that introducing stochasticity through our probabilistic UNet better captures climate variability than comparative deterministic models.

On the necessity of human insight to improve natural adversarial robustness | *IFT-6168 final project* 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: Running, 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*

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