Pierre-Louis Lemaire

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Education

Polytechnique Montréal Expected August 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 August 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 – December 2024
Teaching Assistant, IFT6135 Representation Learning (54 students) *Montréal, Canada*

- Created and corrected intensive theoretical and practical assignments. Contributed to the final exam question bank.
- Held bi-weekly office hours. Gave a tutorial on PyTorch.

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

- Conducted a literature review on the 3D Knapsack problem to design a combinatorial optimization algorithm for truck palletization.
- 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*

- Updated emission factor database and automated data pipelines using web scraping.
- Ensured carbon emission forecasts are accurate and improved ML classifier.

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

- Developed a C# program aiming to accelerate image labeling to train an Azure AI Custom Vision classifier.
- Used Custom Vision to create image classification and object recognition models.
- Integrated an ONNX model using .NET in a Windows application.

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.
- Proposed a probabilistic UNet architecture for the task of multivariate climate downscaling. Specifically, we jointly downscaled precipitation and temperature using simulations from a large RCM ensemble over Quebec.
- Showed that introducing stochasticity through our probabilistic UNet better captures climate variability than comparative models.

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

- Investigated adversarial attacks under a causal perspective and reproduced with PyTorch a causally-inspired adversarial training method.
- Proposed and implemented with PyTorch a style-free contrastive regularization method to improve natural adversarial robustness.
- Compared distribution alignment methods and vanilla learning with natural adversarial augmentations on natural adversarial robustness and found that the proportion of natural adversarial samples per batch plays an important role for robustness.

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

- Implemented (in Python and R) dimensionality reductions algorithms (PCA, LDA), clustering methods (kmeans, HAC, GMM) and advanced factorial methods (CA, MCA, MDS, NMF).
- 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*

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