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LinkedIn Profile

Gwendolyne Legate

I am a Ph.D. candidate at Mila-Quebec AI Research Institute and Concordia University. My current research involves optimizing communication strategies for federated learning via efficient algorithms for resource constrained edge devices and using model compression with a focus on communicating only the most relevant features from statistically heterogeneous client nodes.

Education

exp. grad. 04/2027 — **Concordia University/MILA**, *Ph.D.*, *Computer Science*.

Supervisor: Dr. Eugene Belilovsky

Co Supervisor: Dr. Irina Rish

Description: The primary goal of my PhD is to optimize resource utilization in federated learning by improving local update algorithms and investigating model compression schemes.

2023 — **University of Montreal/MILA**, *M.Sc.*, *Computer Science with specialization in artificial intelligence*.

Supervisor: Dr. Eugene Belilovsky

Title: *Re-Weighted Softmax Cross-Entropy to Control Forgetting in Federated Learning*

Description: This thesis tackles heterogeneous federated learning by framing it as a local catastrophic forgetting phenomenon. We propose a modification to the cross-entropy objective to re-weight the softmax of the logits prior to computing the loss which we demonstrate is an effective mitigation strategy.

2021 — **Concordia University**, *B.Eng.*, *Software Engineering*.

2011 — **Mount Allison University**, *B.Sc.*, *double major in physics and chemistry*.

Work Experience

Jan 2021 – present — **Ph.D. Student Researcher**, Mila, Montreal, QC.
I investigate methods that can reduce the communication and computation burdens of federated/distributed AI model training and have so far published two papers in the field. Experiments are developed after extensive literature reviews and collaborative problem solving with other scientists. They are conducted on compute clusters using AI tools including PyTorch and CUDA.

June 2024 – Sep 2024 present — **Research Intern: Generative AI**, Sony Group Corporation, Tokyo, Japan.
Hosted by the Foundation AI Lab, I investigated the properties of the latent space in diffusion models with the goal of improving our ability to make disentangled image edits. This work contributes to our fundamental understanding of the properties of generative AI models and will help develop novel editing pipelines.

Nov 2020 – Dec 2023 — **Data Scientist**, Environment and Climate Change Canada, Montreal, QC.
I led development of a cloud solution for ECCC's internal and external data marts which made use of Azure cloud services to effectively store, retrieve and modify data as required by clients. This solution was developed using React, typescript and Azure cloud services as well as testing frameworks PyTest and Cypress to ensure code efficiency and maintainability. The data mart has a wide user base so this project also required frequent coordination with external stakeholders which I managed through clear email and Microsoft team communication as well as periodic face-to-face progress updates with concerned parties.

Sept 2014 – Nov 2020 **Meteorologist**, Environment and Climate Change Canada, Montreal, QC.
I Produced weather forecasts working closely with numerical weather prediction (NWP) model output. As a member of the development team, I developed software solutions for weather products used by other operational forecasters using NWP model output with python back ends and javascript frameworks such as Azure and React for the front end

Aug 2013 – May 2014 **Junior Meteorological Intern**, WSP (fmr. Golder Associates Ltd.), Mississauga, ON.
I Installed the Weather Research and Forecasting Model (WRF) on Golder's linux cluster and determined how to run simulations for atmospheric dispersion of pollutants, including a small research project to discover optimal hyper-parameters for simulations in Canada's far north. WRF replaced an older, out of date model and and all subsequent dispersion modeling simulations included in environmental impact reports were conducted using WRF. The initial installation required root level cluster management of required packages, I also verified and pre-processed inputs in GRIB and NetCDF formats. Finally, I consolidated my findings into an internal report and outlined procedures to run different simulation types in a user manual for WSP employees.

Publications

Gwen Legate, Nicolas Bernier, Lucas Caccia, Edouard Oyallon, and Eugene Belilovsky. Guiding the last layer in federated learning with pre-trained models. *Advances in Neural Information Processing Systems (NeurIPS)*, 2023, *(Arxiv link)*.

Gwen Legate, Lucas Caccia, and Eugene Belilovsky. Re-weighted softmax cross-entropy to control forgetting in federated learning. *2nd Conference on Lifelong Learning Agents (CoLLAs)*, 2023, *(Arxiv link)*.

Awards and Honors

2024-2025 **Borealis AI Fellowship**, *$10 000 fellowship awarded to 10 exceptional graduate students across Canada each year*.
2024-2027 **FRQNT Doctoral Training Scholarship**, *$91 667 scholarship awarded to top students in STEM*.
2023-2027 **Split Graduate Fellowship GCS**, *$28 000 Graduate Fellowship*.
2021 **Instructional Technology Award**, *$1000 Merit based Scholarship*.

Relevant Courses

Winter 2023 **Robust & Federated Learning**.
Seminar course on recent advances in federated learning including privacy and domain generalization. Included a course project where my group investigated how to add momentum to updates in de-centralized federated learning.

Winter 2023 **Scaling, Alignment & Emergent Behaviors in Neural Nets**.
Seminar course on recent advances in foundation models pre-trained on very large, diverse datasets. Included a course project investigating the effects of scaling federated learning models.

Winter 2021 **Matrix and Tensor Factorization Techniques for Machine Learning**.
Covered linear and multilinear algebra techniques for designing/analyzing ML algorithms and models, and introduced open areas of research. Involved a final project researching and developing efficient ways of implementing tensor methods for supervised image classification.

Fall 2020 **Self-Supervised Representation Learning**.
Seminar course on SSL including a group project that involved re-implementing and evaluating an existing SSL paper.

Fall 2018 **Data Structures and Algorithms**.
Covered common data structures and algorithms in computer science and emphasises the link between algorithms and efficient coding practices.

Technical Skills

Pytorch, *high level of proficiency*.

GRIB and NetCDF data, *high level of proficiency*.

Python, *high level of proficiency*.

Git, *high level of proficiency*.

Bash Scripting, compute clusters, Slurm, *high level of proficiency*.

Javascript/Typescript, *medium-high level of proficiency*.

MATLAB, *medium-high level of proficiency*.

CUDA, *medium level of proficiency*.

Java, *medium level of proficiency*.

SQL, *medium level of proficiency*.

C++, *low level of proficiency*.

Professional Development

2025 **CVPR Reviewer**.

2023 **Google CS Research Mentorship Program 2023B**.

2023 **Graduate Leadership Development Program**, *Concordia University*.

Languages

English, *Fluent*.

French, *Professional working proficiency*.