David Latortue Machine Learning Research & Software Engineer

Relevant Work Experience

CAE *Machine Learning Engineer* Montreal, *May 2022 – Present*

Magnetic Field Anomaly Detector

· Spearheaded the development of a deep neural network-based CNN time-series architecture for submarine tracking using PyTorch, trained on Azure.

· Collaborated with stakeholders to define requirements and align research with business needs, developed a model improving detection accuracy by 30%, enabling the system to detect the full range of anomalies across different noise types, a capability unattainable with the previous analytical solution.

Aircraft Intrusion Detector

· Developed a cutting-edge cybersecurity solution for the Mil1553 protocol, a widely used communication protocol in aviation and military vehicles that lacks built-in security features due to its design predating modern cybersecurity concepts. Leveraged PyTorch neural network variational autoencoder and Scikit-Learn One-Class SVM to build an unsupervised machine learning system for analyzing Mil1553 bus data.

· Achieved an 85% intrusion detection rate with minimal false positives, relying solely on normal traffic training data.

LIVIA *Research Student* Montreal, *May 2021 – November 2024*

Gaussian Self Attention Transformer *Currently under review by TMLR*

· Addressed inefficiencies in Transformer self-attention, which is computationally expensive and suffers from unstable training. Proposed the GauTransformer, built with PyTorch, featuring a Gaussian Attention module (GauAttention) that samples a single key per query using a learnable Gaussian distribution, improving attention map discovery and stabilizing training for vanilla Transformers through knowledge distillation.

· Achieved a fourfold ($\times$4.56 speedup) reduction in training steps on ImageNet($\sim$1.3 M Images), maintaining competitive performance while significantly reducing computational costs.

MiPa: Mixed Patch Infrared-Visible Modality Agnostic Object Detection *Early Acceptance to WACV 2025*

· Tackled the challenge of modality imbalance in object detection (OD) using RGB and IR data with a single shared vision encoder. Proposed MiPa (Mix Patches), a novel training technique built with PyTorch, which combines modality-agnostic patch mixing with a transformer-based OD encoder to efficiently learn balanced representations.

· Achieved state-of-the-art results on the LLVIP (98.2 % mAP) and FLIR (81.3 % mAP) benchmarks, demonstrating the ability to effectively handle both IR and RGB modalities while requiring only one modality during inference.

Distech Controls *Research Intern* Montreal, *May 2023 – April 2024*

Evaluating Supervision Levels Trade-Offs for Infrared-Based People Counting *Workshops of WACV 2024*

· Addressed the challenges of people counting in privacy-sensitive applications using infrared images, which require costly bounding box annotations. Investigated the impact of weaker supervision (image-level annotations) on deep learning models (CNNs and Transformers) for person counting and localization.

· Showed that a CNN trained with image-level annotations achieves competitive accuracy (88.5 %) with YOLO (91.1%) and DINO (91.0%) detectors with less supervision, offering higher frame rates and similar model complexity, providing Distech Controls with a cost-effective alternative to traditional object detectors. The model was trained using CUDA and quantized using ONNX and TFLite.

Personal and Course Projects

Real Estate Alpha *REA Website*

Developed a web-based tool (served through Flask and PostgreSQL on Render) to evaluate real estate investments using risk-adjusted 'alpha' values, adapting CAPM model. The tool calculates price predictions and a novel beta risk metric, with data collected via a Scrapy web scraper and preprocessed using Pandas and NumPy. Machine learning ensemble, developed using PyTorch (FT-Transformer) and Scikit-Learn (LightGBM, RandomForest), predict property cap rate based on datasets of $\sim$160k and $\sim$60k listings, respectively, achieving RMSLEs of 0.1121 for rentals and 0.1851 for sales. The Vue.js interface allows investors to compare properties and identify high-potential investments.

Voice Control System for Hospitals

Developed a P-O-C voice control system for hospital TV apps in collaboration with a startup, using Java and CMUSphinx. The system allows patients with mobility impairments to control TV apps and issue emergency alerts. Key features include: (1) CMUSphinx-based speech recognition for accurate command processing in noisy environments, (2) Java middleware translating commands into actionable tasks for hospital systems, and (3) an alert mechanism for notifying staff. The prototype was adopted and integrated into the startup's commercial product.

Publications

Surely but quickly: Quick convergence using Self Sampling Attention. ***D Latortue****, HR Medeiros, M Pedersoli. Under review for TMLR.*

MiPa: Mixed Patch Infrared-Visible Modality Agnostic Object Detection. *HR Medeiros,* ***D Latortue*** *et al. (Early Acceptance [12.1%] WACV 2025).*

Modality Translation for Object Detection Adaptation Without Forgetting Prior Knowledge. *HR Medeiros, M Aminbeidokhti, F Guerrero Pena,* ***D Latortue*** *et al.* (ECCV 2024).

Evaluating supervision levels trade-offs for infrared-based people counting. ***D Latortue****, M Kdayem et al.* (WACV 2024).

Additional Information

Technical Skills: ***ML*** Data processing & modeling, Classification, Regression, Statistics, Probability, Clustering, Object Detection, CNNs and Transformers | ***ML Frameworks*** Pytorch, Pandas, Numpy, JAX, SKLearn, Matplotlib, Tensorflow, Keras, ONNX, Cuda | ***Prog. Lang.*** Python, Java, Scala, Javascript/Typescript, C/C++ | ***Web*** HTML, CSS, React, VueJS, Django, SQL, Springboot, Scrapy, PostgreSQL, Kubernetes

Language Spoken: English, French & Haitian Kreyol

Interests: Fashion Enthusiast, Immersive & traditional art exhibitions aficionado, Hip-Hop Nerd and Foodie (I maintain a personal guide).

Education

M.A.Sc. in Computer Vision & Machine Learning *(with Honours)* *École de technologie supérieure, 2021–2024*

B.Eng. in Software Engineering *École de technologie supérieure, 2017–2021*