

PAUL NOVELLO

ML Research Engineer

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in paul-novello-a036b1a1

EXPERIENCE

Research scientist

IRT Saint Exupéry

March 2022 – Now

Toulouse, France

- Core member of DEEL (DEpendable and EXplainable Learning) project, part of Artificial and Natural Intelligence Toulouse Institute (ANITI). Research on Trustworthy AI (Explainable AI - XAI, Safe AI, Robustness, Uncertainty Quantification), in collaboration with Academics and industrials.
- Lead of the Out-Of-Distribution (OOD) detection research project. Close collaboration with MILA, Airbus and Renault.
- Lead developer of **oodeel**, an open-source library for post-hoc OOD detection on pre-trained Pytorch and Tensorflow deep neural networks.
- Research on Explainable AI (XAI)
- 3D prediction of pollutant diffusion in urban areas: Used Fourier Neural Operators (FNO) as Surrogate models for the prediction of pollutant diffusion in 3D meshes of urban areas, extending the 2D model of **Mendil et al** that was based Multi-Layer Perceptrons (MLP). Joint work with The French Alternative Energies and Atomic Energy Commission (CEA).
- Supervised a group of 3 PhD candidates during the **CEMRACS** hackathon, on the project "Towards instance-dependent approximation guarantees for scientific machine learning using Lipschitz neural networks".
- Oral Communications (NeurIPS Paris, Open Source Experience, UQSay, GDR Mascotnum, Algoritmy, Meetups, Internal...).

PhD Candidate

Ecole Polytechnique, French Alternative Energies and Atomic Energy Commission (CEA) CESTA, INRIA Saclay

Nov 2018 – March 2022

Bordeaux - Palaiseau, France

- Deep Learning for Scientific Machine Learning (SciML) and High Performance Computing (HPC) applications, specifically Computational Fluid Dynamics.
- Large Hyperparameter Optimization on CEA's cluster with 400 GPUs using Slurm.
- Embedding of a Multi-Layer Perceptron (MLP) trained in TensorFlow in a real-world Fortran/C++ simulation code using Tensorflow C++ API. Modification of the original Fortran C++ code to leverage neural network's vectorization.

Data Scientist - Intern then Remote as a Freelance

Intento>

June 2017 – Nov 2018

Bordeaux, France

- Contribution to a server built with Flask, automatically processing MariaDB visitor databases from client websites.
- Implementation of data analysis algorithms: website visitor's fidelity scoring, visitor's profile clustering, and classification based on their navigation path, using TraMineR a Genomics sequence clustering package in R.

EDUCATION

PhD, Applied Mathematics

Ecole Polytechnique

2018 – 2022

Palaiseau, France

- Combining supervised deep learning and scientific computing: some contributions and application to computational fluid dynamics.

MSc, Statistics

Imperial College London

2017 – 2018

London, UK

- Specialization in Machine Learning and Computational Statistics.

Diplôme d'Ingénieur

Telecom ParisTech

2014 – 2018

Paris, France

- Major in Statistical Modeling and Scientific Computing, Signal Processing

SKILLS



MISCELLANEOUS

- Sports: climbing, hiking, tennis
- Indie rock, contemporary jazz and techno music. I'm working towards confidently participating in jam sessions with my bass.
- Reading and watching about non mathematical sciences, economy, geopolitics ...
- Got married in Sep. 2020, despite Covid19 !
- Permis B

LANGUAGES

- French: Native
- English: Fluent
- Spanish: Intermediate

PUBLICATIONS

Out-of-Distribution Detection Should Use Conformal Prediction (and vice-versa?)

Conference paper - submitted to ICML 2024

📅 2024

- Used Conformal prediction to interpret Out-of-distribution scores and provide probabilistic guarantees and used OOD scores to construct conformal prediction sets.

Robust One-Class Classification with Signed Distance Function using 1-Lipschitz Neural Networks

Conference paper - ICML 2023

📅 2023

- Used 1-Lipschitz networks to learn signed distance function from a data point cloud. The algorithm allows One-class classification with robustness guarantees and Implicit Neural Representation.

Making Sense of Dependence: Efficient Black-box Explanations Using Dependence Measure

Conference paper - NeurIPS 2022

📅 2022

- Attribution method (XAI) by measuring the dependence between regions of an input image and the output. Application in Image Classification and Object Detection.

Accelerating hypersonic reentry simulations using deep learning-based hybridization (with guarantees)

Journal paper - Journal of Computational Physics

📅 2022

- Replacing costly part of strongly coupled simulation code by neural networks.
- Guarantees for the accuracy of the obtained hybrid code

Goal-oriented sensitivity analysis of hyperparameters in deep learning

Journal paper - Journal of Scientific Computing

📅 2021

- Adapting Hilbert-Schmidt Independence Criterion (HSIC) to measure the relative importance of hyperparameters and improve hyperparameter optimization.
- Intensive hyperparameter optimization of MLPs and Convolutional Networks on 400 GPUs using Slurm.

Leveraging local variation in data: sampling and weighting schemes for supervised deep learning

Journal paper - Journal of Machine Learning for Modeling and Computing

📅 2020

- Improving the accuracy of Deep Neural Networks by weighting the samples of the training data set.

SIDE EXPERIENCE

Tutorial teacher (khôlles) in Mathematics

Lycée Chaptal - CPGE

📅 2015 - 2016

📍 Paris, France

Associative Experience

Project Manager

Télécom Etude

📅 2015 - 2016

📍 Paris, France

- Telecom's Junior Entreprise: managed projects conducted by Telecom ParisTech students for start-ups.

President

La Scène

📅 2015 - 2016

📍 Paris, France

- Regular organization of averagely 250 people concerts.

Internships

Data Scientist

Intento>

📅 2017

📍 Bordeaux, France

Business Developer

nFinite

📅 2017

📍 Paris, France

Consultant

Tera Consultants

📅 2016

📍 Paris, France

Taylor Based Sampling Scheme for Machine Learning

Workshop paper - NeurIPS 2019

📅 2019

- Methodology for sampling efficient designs of experiments for Machine Learning in Computational Physics.
- Accepted in Second Workshop on Machine Learning and the Physical Sciences (NeurIPS 2019).

Deep Unsupervised Representation Learning

MSc Thesis

📅 2018

- Unsupervised representations of the visual concept of counting from images using Autoencoders and Generative Adversarial Networks (GAN)s.
- Evaluation of randomness in artificial dynamics such as cellular automata using Recurrent Neural Networks (RNN)s.