GENERATIVE AI PHD STUDENT

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NICOLAS DUFOUR

PROFESSIONAL EXPERIENCE

Meta
Applied Research Intern
July 2022-October 2022, London, UK
Supervised by Vincent MOENS.
Worked on integrating Model Based Reinforcement Learning to torchrl, a Pytorch domains library.

Ecole Nationale des Ponts et Chaussées (ENPC) and Ecole Polytechnique
PhD Student
October 2021-September 2025, Paris, France
Supervised by David PICARD and Vicky KALOGEITON.
Worked on improving the conditioning and alignement of Generative Models.

Ecole Nationale des Ponts et Chaussées (ENPC) and Ecole Polytechnique
Research Intern
April 2021-September 2021, Paris, France
Supervised by David PICARD and Vicky KALOGEITON.
Worked on subject transfer and conditional Generative Adversarial Networks (cGANs). Designed a novel semantically conditioned GAN architecture improving the state of the art. Joint internship between IMAGINE (ENPC) and GeoViC (Ecole Polytechnique) labs.

Upskills
Machine Learning Engineer Internship
February 2020-July 2020, Singapore
Worked on detecting fraudulent patterns between traders with anomaly detection for one of the largest Asian banks. Worked with Graph Neural Network in an unsupervised setting. Created a dataset from Murex trading data using Spark. Worked on novelty detection leveraging a Variational Auto-Encoder (VAE) architecture.

Boyce Thompson Institute - Cornell University
Research Internship
June 2018 / August 2018, Ithaca, NY, USA
Worked on a better way to store genotypic data. Tools such as Hadoop, Spark and the Parquet file format were used to optimize the storing performance. Developed some custom algorithms in Python to fit the data needs. Presented the results by a poster to a wide audience of researchers.

RESEARCH PAPERS

How far can we go with ImageNet for Text-to-Image generation?
Lucas Degeorge*, Arijit Ghosh*, **Nicolas Dufour***, David Picard, Vicky Kalogeiton*
We show that, contrary to the common belief, a small dataset of 1.2M images like ImageNet can be used to train a T2I model that matches or outperforms models trained on massive web-scraped collections.
Project page: https://lucasdegeorge.github.io/projects/t2i_imagenet/

Around the World in 80 Timesteps: A Generative Approach to Global Visual Geolocation
CVPR 2025
Nicolas Dufour*, Vicky Kalogeiton, David Picard, Loic Landrieu*
Pioneered a probabilistic visual geolocation framework using diffusion and Riemannian flow matching that outperforms existing deterministic methods with improved accuracy and uncertainty quantification.
Project page: https://nicolas-dufour.github.io/plonk.html

PoM: Efficient Image and Video Generation with the Polynomial Mixer
David Picard, **Nicolas Dufour**
Introduced the Polynomial Mixer (PoM), an innovative Multi-Head Attention replacement with linear computational complexity for image and video generation in diffusion models.

E.T, the Exceptional Trajectories: Text-to-camera-trajectory generation with character awareness
ECCV 2024
Robin Courant, **Nicolas Dufour***, Xi Wang, Marc Christie, Vicky Kalogeiton*
Proposed a novel dataset and diffusion-based approach to generate complex camera trajectories from textual captions, contributing to democratizing cinematography for common users.
Project page: https://www.lix.polytechnique.fr/vista/projects/2024_et_courant/

NICOLAS DUFOUR

Analysis of Classifier-Free Guidance Weight Schedulers
TMLR 2024

*Xi Wang, **Nicolas Dufour**, Nefeli Andreou, Marie-Paule Cani, Victoria Fernandez Abrevaya, David Picard, Vicky Kalogeiton*

Analyzed classifier-free guidance weight schedulers and found that simple, monotonically increasing weights consistently improve performance and diversity of generated images with minimal code changes.

Don't drop your samples! Coherence-aware training benefits Conditional diffusion
CVPR 2024   Highlight (TOP 11%)

***Nicolas Dufour**, Victor Besnier, Vicky Kalogeiton, David Picard*

Proposed Coherence-Aware Diffusion to integrate coherence in conditional information, enabling models to learn from noisy annotations without discarding data.

Project page: https://nicolas-dufour.github.io/cad

OpenStreetView-5M: The Many Roads to Global Visual Geolocation
CVPR 2024

Guillaume Astruc, **Nicolas Dufour***, Ioannis Siglidis*, Constantin Aronssohn, Nacim Bouia, Stephanie Fu, Romain Loiseau, Van Nguyen Nguyen, Charles Raude, Elliot Vincent, Lintao XU, Hongyu Zhou, Loic Landrieu**

Introduced a large-scale, open-access dataset of 5.1 million geo-referenced street view images and benchmarked state-of-the-art image encoders, spatial representations, and training strategies.

Project page: https://osv5m.github.io/

SCAM! Transferring humans between images with Semantic Cross Attention Modulation
ECCV 2022

***Nicolas Dufour**, David Picard, Vicky Kalogeiton*

Introduced SCAM for semantically conditioned image generation, focusing on subject transfer.

Project page: https://nicolas-dufour.github.io/scam

For older projects see https://github.com/nicolas-dufour

EDUCATION

Ecole Nationale des Ponts et Chaussées (ENPC) and Ecole Polytechnique
PhD Student
October 2021-September 2025, Paris, France
Supervised by David PICARD, Vicky KALOGEITON and Loic LANDRIEU
Worked on improving the conditioning and alignment of Generative Models.

ENS Paris Saclay
MVA Master (Mathematics, Vision and Learning)
October 2020 to September 2021, Paris, France
Master of Science specialized in computer vision, applied mathematics and machine learning.

Télécom SudParis - Institut Polytechnique de Paris
Engineering diploma
September 2017 to September 2020, Evry, France
One of the top French Engineering Schools. Followed the MSA speciality (Modelisation, Statistics and Applications) which teaches the intricacies of statistical learning.

CPGE Joffre MPSI
MP speciality Computer Science
September 2014 to July 2017, Montpellier, France
Intensive preparation in Math and Physics for the highly competitive entrance exams to the French Grandes écoles. CPGE stands for Classes Préparatoires aux Grandes Écoles.

Lycée Français Paul Valéry de Cali
Baccalauréat with High Honors
September 2006 to July 2014, Cali, Colombia
Lived 8 years in Cali, Colombia and attend French School, a trilingual school (French, Spanish and English).

SKILLS

Languages spoken
- French (Bilingual)
- Spanish (Bilingual)
- English (990 points Toeic)
- Portuguese (Beginner)

Software proficiency
Google Cloud Computer, Photoshop, Inkscape, Premiere, Latex, SLURM.

Soft Skills
Project Management, Fast Learner, Communication, Problem solving, Entrepreneurial spirit, Curious, Creative

Programming language
Python (Pandas, Numpy, Scikit-learn, Matplotlib, Seaborn, Plotly, Hadoop, Spark, Plotly), Javascript (React, AngularJS, NodeJS, Socket.io), HTML5/CSS3, Bash, SQL, Caml.

Deep Learning Stack
Pytorch, Pytorch Lightning, Wandb, Hydra.

OPEN-SOURCE CONTRIBUTIONS

TorchRL
Worked on the model based aspect of the library

Torchmetrics
Improved the FID metric to work online, avoiding storing features.

Huggingface/diffusers
Implemented the sampling for K-LMS sampler

AWARDS & REVIEWS

Outstanding reviewer at ACCV 2022
Recognized for outstanding reviewing contribution

REVIEWS
Reviewer at AAAI 2024, ECCV 2024, CVPR 2024, WACV 2024, ICCV 2023, ACCV 2022.