

# Elias Ramzi | AI Research Scientist

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**Researcher specialized in Deep Learning and Computer Vision.**

## Experiences

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**PhD in Computer Science, Cnam & Coexya (France) - 3 year PhD** 2021-2024

My PhD in deep learning is focused on computer vision and image retrieval:

- Published three papers in major international machine learning conferences (NeurIPS, ECCV, ICML), two of which as first author.
- Worked in computer vision for image retrieval, on topics such as ranking losses and hierarchical data from both mathematical and experimental aspects.
- Collaborated with an industrial researcher (Google research) to release the first hierarchical landmark image retrieval dataset [🔗](#) as part of a submission to a journal (under-review, TPAMI). It has 1.4m images and three levels of hierarchies: 100k unique landmarks, 78 super-categories and 2 final labels.
- Used the public HPC cluster Jean Zay [🔗](#) to train neural networks in a distributed fashion with up to 4 nodes totaling 16 GPUs.
- Co-supervised an intern at Coexya during 6 months to work on weakly-supervised learning.
- Collaborated with two PhD students at Cnam, leading to a pre-print on collaborative filtering using graph neural networks and an ICML'23 publication on out-of-distribution detection using energy-based models.
- Lead 20 hours of machine learning and deep learning lab works as a teaching assistant at Cnam.
- Adapted HAPPIER (ECCV 2022) to trademark logo retrieval, HAPPIER is now used to train models that go in production in Coexya's Acseptio.

**Research intern in deep learning, Cnam (France) - 5 month internship** 2020

Deep learning for 3D medical image segmentation. I used a learned confidence measure (ConfidNet) to combine segmentation results from different 2D U-Nets.

**Data engineer / Data scientist, Sancare (France) - 6 month internship** 2019

Deep learning applied to healthcare. I participated in the development of a data pipeline to extract data from the hospitals' servers to Sancare's data model. I worked on the interpretability of a deep neural network using the layer-wise relevance propagation.

**Data engineer, Balto (Australia) - 6 month internship** 2018

Startup working on last mile delivery of fresh food. I worked on the automation of data processing.

## Education

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**PhD in Computer Science, Cnam & Coexya (France)** 2021-2024

I investigate deep learning approaches to image retrieval. Specifically, I work on designing appropriate ranking losses to train deep neural networks for image retrieval. I also contributed on out-of-distribution detection using energy-based models and worked on collaborative filtering recommendation using graph neural networks.

Supervisor: Nicolas Thome [🔗](#) (Sorbonne Université, Paris, France).

Advisors: Nicolas Audebert [🔗](#) (IGN, Paris, France); Clément Rambour [🔗](#) (Cnam, Paris, France).

Industrial advisor: Xavier Bitot [🔗](#) (Coexya, Paris, France).

**Engineering diploma, CentraleSupélec (France)** 2016-2020

Courses in signal processing (sound, image, speech), machine learning, statistical models (estimators, Bayesian learning), data science (data mining, sparse data representation, NLP).





**Preparatory school, PSI\*, Lycée Lakanal (France)** 2014-2016

Intense courses in mathematics and physics.

## Technical skills

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### Open source projects

- Code to train out-of-distribution detectors with HEAT (ICML'23):  HEAT.
- First of its kind hierarchical landmark dataset (TPAMI, under review):  google-landmark.
- Code to train models with HAPPIER (ECCV'22) for hierarchical image retrieval  HAPPIER.
- Code to train models with ROADMAP (NeurIPS'21) for image retrieval:  ROADMAP.

### Technologies

- My programming language: Python (PyTorch, NumPy, Hydra, Pandas, Scikit-Learn, Jax).
- My work environment : Linux/macOS + Git + VS Code & GitHub Copilot + Jupyter Notebook.
- Other tools: LaTeX, SLURM, Shell script.

### Contributions to open-source

- Pytorch metric learning:  pytorch-metric-learning.
- Implementation of Mixture of Experts:  mixture-of-experts.
- Pytorch-lightning:  lightning.
- Universal Image Embeddings:  Universal-Image-Embeddings.

## Miscellaneous

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- French is my mother tongue and I speak English at C1 level.
- I enjoy running and have run semi-marathon and trail races. I also like hiking and climbing.

## Publications

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**Elias Ramzi**, Nicolas Audebert, Clément Rambour, André Araujo, Xavier Bitot and Nicolas Thome. "Optimization of Rank Losses for Image Retrieval." Under review, IEEE Transactions on Pattern Analysis and Machine Intelligence (under-review – TPAMI). online: <https://arxiv.org/pdf/2309.08250.pdf>

Marc Lafon, **Elias Ramzi**, Clément Rambour, Nicolas Thome. "Hybrid Energy Based Model in the Feature Space for Out-of-Distribution Detection." in Proceedings of the 40<sup>th</sup> International Conference on Machine Learning (ICML, 2023). online: <https://arxiv.org/abs/2305.16966>

**Elias Ramzi**, Nicolas Audebert, Nicolas Thome, Clément Rambour, and Xavier Bitot. "Hierarchical Average Precision Training for Pertinent Image Retrieval." in Proceedings of the 17<sup>th</sup> European Conference on Computer Vision (ECCV, 2022). online: <https://arxiv.org/abs/2207.04873>

**Elias Ramzi**, Nicolas Thome, Clément Rambour, Nicolas Audebert, and Xavier Bitot. "Robust and Decomposable Average Precision for Image Retrieval." Advances in Neural Information Processing Systems, 34<sup>th</sup> (NeurIPS, 2021). online: <https://arxiv.org/abs/2110.01445>