

Internship Proposal

Learning Common and Salient Generative Factors between two Medical Imaging Datasets or Modalities with Diffusion Models

Keywords: Deep learning, Contrastive Analysis, Multi-view learning, Medical Imaging, Generative models

Context Recent advancements in diffusion-based models have enabled high-quality image generation and manipulation. Most works focus on:

1. Image synthesis quality
2. Conditional manipulation, where an image is modified based on a given attribute, or
3. Disentangled representation learning, where each latent direction corresponds to a distinct semantic attribute.

In this internship, we focus on a different and less explored research problem called Contrastive Analysis (CA) and multi-view Representation Learning. Given two datasets (e.g., healthy vs. patient) or two imaging modalities (e.g., T1-w MRI and FLAIR), our goal is to separate the common generative factors shared across both datasets/modalities from the salient factors specific to only one dataset (e.g., patients) or modality.

Objectives Building on previous research conducted by our team on Contrastive Analysis [1,2,3,4], the student will extend a recently proposed method [1], based on diffusion models, capable of estimating the common generative factors, shared between the two datasets/modalities, and the salient ones, proper to each dataset/modality. The model will be tested on medical images (Brats, BRACS, ChestExpert, MedMNIST) and evaluated on different downstream tasks, such as segmentation with missing modality, counterfactual analysis, domain adaptation and image retrieval.

When Deadline to candidate: 03/2026

Team This project will be carried out under the supervision of P. Gori (Télécom Paris, IPParis).

Required background Master 2 student in applied mathematics, statistics, computer science, engineering with a good knowledge of Machine/Deep Learning and Python.

How to apply Candidates are invited to send a CV and the grades of the last two years to pietro.gori@telecom-paris.fr detailing their academic background and motivation

References

- [1] Learning Common and Salient Generative Factors Between Two Image Datasets. Yunlong He, Gwilherm Lesné, Ziqian Liu, Michaël Soumm and Pietro Gori(Under Review), 2025
- [2] Separating common from salient patterns with Contrastive Representation Learning Robin Louiset, Edouard Duchesnay, Antoine Grigis, and Pietro Gori In International Conference on Learning Representations (ICLR), 2024
- [3] Double InfoGAN for Contrastive Analysis Florence Carton, Robin Louiset, and Pietro Gori In International Conference on Artificial Intelligence and Statistics (AISTATS), 2024
- [4] SepVAE: a contrastive VAE to separate pathological patterns from healthy ones Robin Louiset, Edouard Duchesnay, Antoine Grigis, Benoit Dufumier, and Pietro Gori In Medical Imaging with Deep Learning (MIDL), 2024