PhD thesis position 2025

Responsible AI bridging Computational Pathology and Spatial Transcriptomics in Neuropathology

Keywords: Computational Pathology, Whole Slide Imaging, Spatial Transcriptomics, Neuropathology, Deep Learning, Generative AI, Responsible AI, Validation Metrics, Loss Functions.

We invite applications for a PhD position at Aramis Lab, Paris Brain Institute (Institut du Cerveau – ICM), focusing on the intersection of computational pathology, spatial transcriptomics, and responsible AI. This project aims to develop generative AI models and multimodal foundation models that integrate histopathological imaging and transcriptomic spatial data while ensuring robustness, explainability, and fairness in biomedical AI.

Project overview

Neuropathological diseases, including neurodegenerative disorders and brain tumors, require data-driven precision diagnostics that go beyond traditional histopathology. Spatial transcriptomics (ST) provides molecular-level insights into tissue architecture, but effectively integrating ST with histopathological images remains a significant challenge. Recent advancements in generative AI and foundation models offer new opportunities to bridge this gap while addressing key issues of trustworthiness and ethical AI deployment.

This PhD project will focus on:

- Generative AI for multimodal integration: Developing and evaluating diffusion models, variational autoencoders (VAEs), or GANs to enhance spatial transcriptomic and histopathology data fusion.
- Foundation models for computational pathology: Exploring and fine-tuning vision-language models (e.g., CLIP, Segment Anything, PathLM) for spatial transcriptomics and neuropathology applications.
- New loss functions and evaluation metrics: Designing task-specific loss functions to improve interpretability, robustness, and generalization across datasets.
- Responsible AI for clinical deployment: Implementing fairness-aware machine learning approaches and explainable AI (XAI) techniques to ensure transparency and trustworthiness in medical AI.

Your profile

- Master's degree or engineering degree with computer science, signal/image analysis and/or applied mathematics profile
- Strong interest for medical applications
- Knowledge of deep learning
- Knowledge in digital image processing and medical imaging
- Good programming skills in Python
- Good writing skills
- Good relational and communication skills to interact with professionals from various backgrounds

We seek highly motivated candidates with expertise in one or more of the following areas:

- Machine Learning, AI, Computational Pathology, Bioinformatics, or Computational Neuroscience
- Strong background in generative models, deep learning architectures, or foundation models

- Programming skills in Python, PyTorch, and experience with biomedical datasets
- Interest in AI evaluation metrics, loss functions, and responsible AI paradigms

A vibrant scientific, technological and clinical environment

You will work within the ARAMIS Lab (www.aramislab.fr) at the Paris Brain Institute (https://institutducerveau-icm.org/en), one of the world top research institutes for neurosciences. The institute is ideally located at the heart of the Pitié-Salpêtrière hospital, downtown Paris. The ARAMIS Lab, which is also part of Inria (the French National Institute for Research in Digital Science and Technology), is dedicated to the development of new computational approaches for the analysis of large neuroimaging and clinical data sets. With about 40 people, the lab has a multidisciplinary composition, bringing together researchers in machine learning and statistics and medical doctors (neurologists, neuroradiologists). You will interact locally with the PhD students and engineers of the lab, as well as our medical collaborators at the Pitié-Salpêtrière hospital.

The PhD thesis will be directed by Daniel Racoceanu (Professor at Sorbonne University and PI of the Paris Brain Institute), within the support of an echosystem at the interface of AI, computational pathology, and neuroscience, with access to cutting-edge datasets and computational resources. The project will involve collaborations with experts in neuropathology, AI ethics, and machine learning.

Ready to take up the challenge?

Please submit the following documents to Daniel Racoceanu (daniel.racoceanu@sorbonne-universite.fr):

- A CV highlighting relevant experience
- A motivation letter (max 2 pages) detailing research interests and alignment with the project
- Contact details of two references
- Any publications, GitHub repositories, or prior research work

Literature review

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