INTERNSHIP PROPOSALS

A few words about Incepto and you !

What we do
We co-create and distribute AI applications for medical imaging - Bridging the gap between Physicians and Engineers.

Why we do it
With more and more data, Medical Imaging is becoming more and more complex. We use Artificial Intelligence technology to transform Medical Imaging. This is a fantastic opportunity to empower physicians, saving them time, bringing them closer to their patients, and helping most of the population get access to the best modern care.

How we do it
A journey is not only about what we do but also about how we do and look at things. We place our values at the heart of our work. Centered on customer needs, the foundation of our unique team are: Sharing, Expertise, Passion & Humility, Integrity.

Take on the challenge of AI in Medical Imaging!
Together!
www.incepto-medical.com

Internship Proposals

During your internship within the data science team, you will:

- Participate in a clinical immersion to understand the practical aspects of a radiologist's daily job and his interrogation on the problem.
- Work with other experienced data scientists, radiologists, and developers of the team.
- Manage annotation worklists.
- Deliver tools that can fit into a global cloud platform.

Ideally, a good candidate should be interested by both the clinical and the algorithmic aspects of the internship.

We currently offer **5 internship topics (6 months minimum)**, all of which deal with different clinical problems. The content of each of them is presented below.

ARVA

Aorta: Afferent blood vessels detection

For clinical diagnosis reporting, tracking and intervention planning, vascular clinicians have established a partitioning of the aorta in 8 sections: Root, Ascending, Arch, Descending, Suprarenal, Infrarenal, left and right common iliac. Any automatic analysis of the aorta aiming to efficiently communicate its results to vascular clinicians is bound to automatically detect these sections.

These sections are delimited by anatomical landmarks related to afferent blood vessels to the aorta. These are also important for the planning of certain interventions, e.g stent positioning.

You will own the design and development of a model for detecting the afferent blood vessels on aortic contrasted CT scans. The challenge lies in the small size of these structures compared to that of the aorta and the ability of the model to detect them accurately, even on low contrast CT scans.

During this internship you will:

- Propose and implement methods to detect afferent blood vessels.
- Propose from the scientific literature some tools to target afferent vessels detection on low contrast CT scans.
- Participate in immersions with vascular surgeons to learn on how they manually detect them and their importance.

Aorta segmentation on non contrasted CT scans

The existing deep learning algorithm segmenting and performing measurements on the aorta was trained on injected CT scans. Being able to perform the same segmentation and measurements on non-contrasted examination would be beneficial to the patient, not having a contrast agent injected.

You will own the design and development of a model segmenting non contrasted aorta on CT scans. The challenge lies in the annotations of non-contrasted exams or in the methods developed to avoid having to perform supplementary annotations.

During this internship you will:

- Propose and implement methods to segment non contrast aorta

- Propose methods to avoid too much supplementary annotations from the literature

KEROS

Multi-orientation knee-pathologies classification

In order to facilitate diagnosis, medical images of a given body parts are often acquired from different orientations/points of view. It is a challenging task to properly handle the resulting data when it comes to training deep learning algorithms.
During this internship, you will:

- Propose and compare strategies to combine data of the same anatomical regions but acquired from different orientations. In particular:
  - Combine latent spaces of already pretrained, orientation-specific classification models
  - Re-train, “from scratch”, multi-orientation classification models
- Secondary objective : How to include available metadata (age, sex, scanner parameters, etc.) in pretraining to structure the latent space and increase downstream performances ?

Additionally, you should :

- Propose from scientific literature reviews, some paper implementations.
- Participate in the writing of a scientific paper if your results can be published.

Pretraining strategies

When working with medical images, a lot of unannotated and various data can be available, but annotations are much fewer and costly to obtain. Some methods have recently been developed to take full advantage of multi modal [1], multi anatomy [2] and multi domain [3] images to increase algorithms performance at low annotated data regime.
During this internship you will:

- Start by implementing existing pretraining methods from the literature using a consequent database of full knee MRI images
- Launch such pretraining methods combining multi scale images from different knee ROIs
- Apply these pretraining methods to finetune algorithms to detect low prevalence pathologies

Additionally, you should :

- Propose from scientific literature reviews, some paper implementations.
- Participate in the writing of a scientific paper if your results can be published.

[1] Gutiérrez, Yesid, John Arevalo and Fabio Martánez. "Multimodal Contrastive Supervised Learning to Classify Clinical Significance MRI Regions on Prostate Cancer." 2022 44th Annual International Conference of the IEEE Engineering in Medicine & Biology Society (EMBC) (2022): 1682-1685.

[2] Zheng, H., Han, J., Wang, H., Yang, L., Zhao, Z., Wang, C., & Chen, D.Z. (2021). Hierarchical Self-Supervised Learning for Medical Image Segmentation Based on Multi-Domain Data Aggregation. International Conference on Medical Image Computing and Computer-Assisted Intervention.

[3] Yuan, Xin, Zhe L. Lin, Jason Kuen, Jianming Zhang, Yilin Wang, Michael Maire, Ajinkya Kale and Baldo Faieta. "Multimodal Contrastive Training for Visual Representation Learning." 2021 IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR) (2021): 6991-7000.

PAROS

Lesions detection and classification with self and semi-supervised approaches

The aim of the internship is to improve lesion detection and classification models by implementing and proposing new self-supervised approaches (e.g. [3]) using an unannotated multi-parametric MRI database (+6000 exams) and semi-supervised approaches (e.g. [1] or [2]) using unstructured radiological reports.

During this internship you will:

- Start by implementing self-supervised methods from the literature using a multi-parametric MRI datasets
- Propose new approaches to combine image and text data in pre-training
- Apply these pre-training methods to finetune algorithm detecting and classifying prostate lesions

[1] Bosma, J. S., Saha, A., Hosseinzadeh, M., Slootweg, I., de Rooij, M., & Huisman, H. (2023). Semisupervised learning with report-guided pseudo labels for deep learning–based prostate cancer detection using biparametric MRI. *Radiology: Artificial Intelligence*, *5*(5), e230031.

[2] Cao, R., Zhong, X., Scalzo, F., Raman, S., & Sung, K. (2019). Prostate cancer inference via weakly-supervised learning using a large collection of negative MRI. In Proceedings of the IEEE/CVF International Conference on Computer Vision Workshops (pp. 0-0).

[3] Li, Y., Wynne, J., Wang, J., Qiu, R. L., Roper, J., Pan, S., ... & Yang, X. (2023). Cross-Shaped Windows Transformer with Self-supervised Pretraining for Clinically Significant Prostate Cancer Detection in Bi-parametric MRI. arXiv preprint arXiv:2305.00385.

How to apply ?

If you are interested in one of the topics apply here!

https://incepto-medical.welcomekit.co/jobs/candidatures-spontanees