FIRE 2025
Marseille
Novembre 2025

Tom.boeken@aphp.fr


GEST FOCUSED TOPIC MEETING
MSK
GEST
Musculoskeletal
Embolization
SAVE THE DATE
Marriott Rive Gauche Hotel - Paris
JANUARY, 17th • 18th • 2026
www.gestmsk.com
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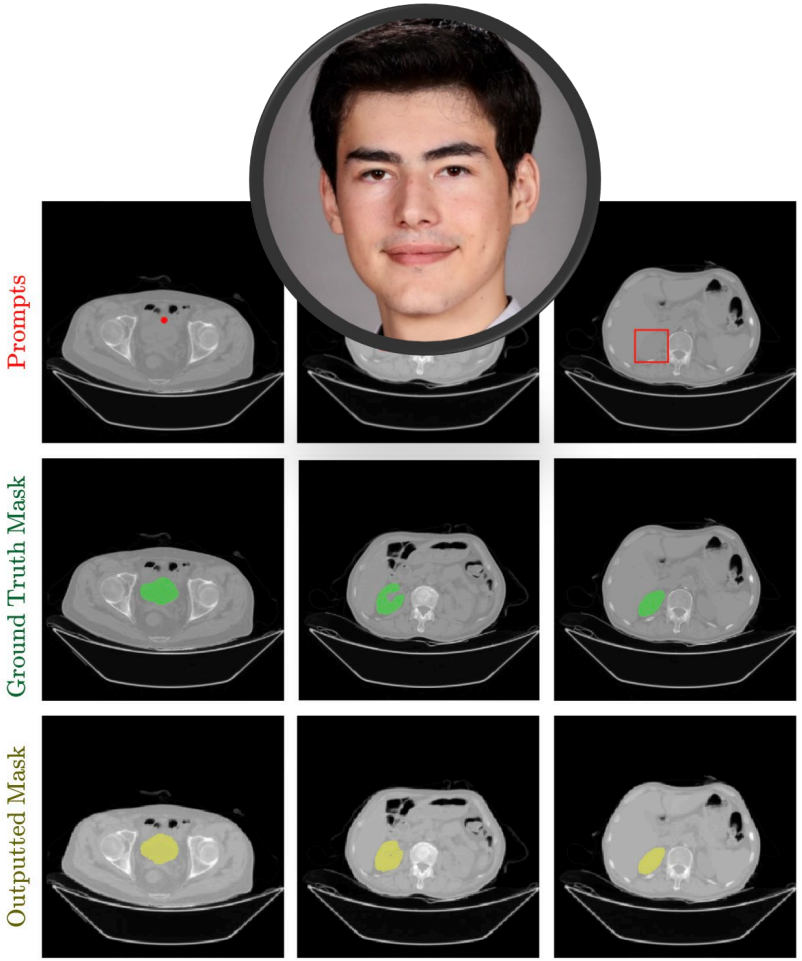
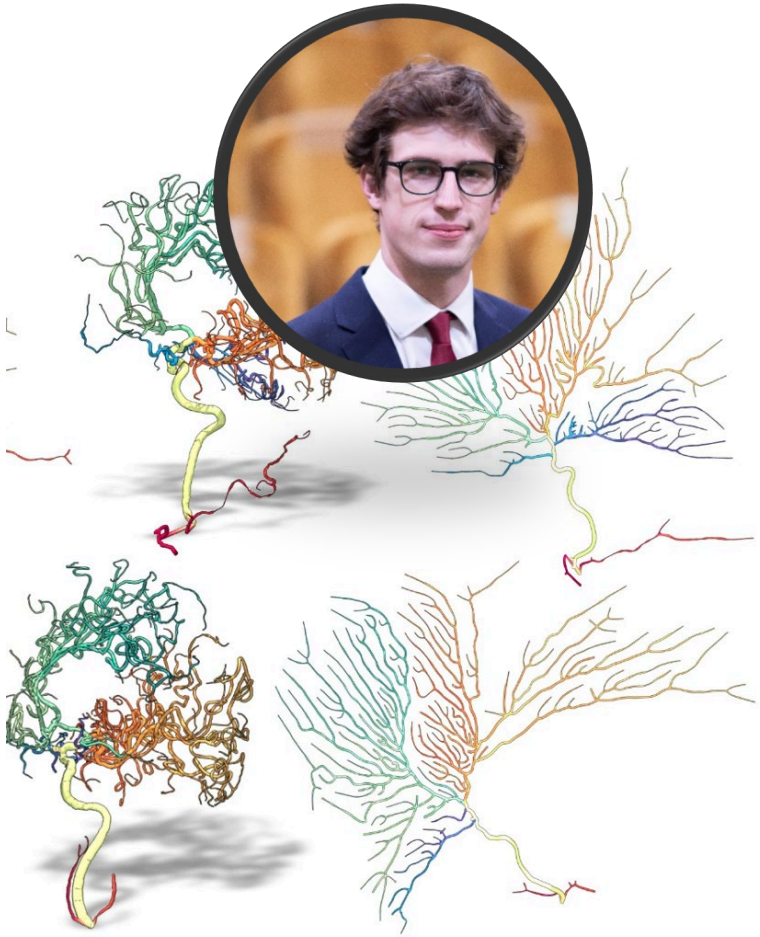
MICCAI 2025
Daejeon
REPUBLIC OF KOREA

28th INTERNATIONAL CONFERENCE ON MEDICAL IMAGE COMPUTING
AND COMPUTER ASSISTED INTERVENTION
23-27 SEPTEMBER 2025 • DAEJEON CONVENTION CENTER





Challenges identifiés pour l'autonomie

A.

Compréhension de *ce que l'on fait*

cathéter, coils, agent embolique, contraste, ciment, aiguilles

B.

Compréhension de *ce que l'on traite*

tumeur, thrombus

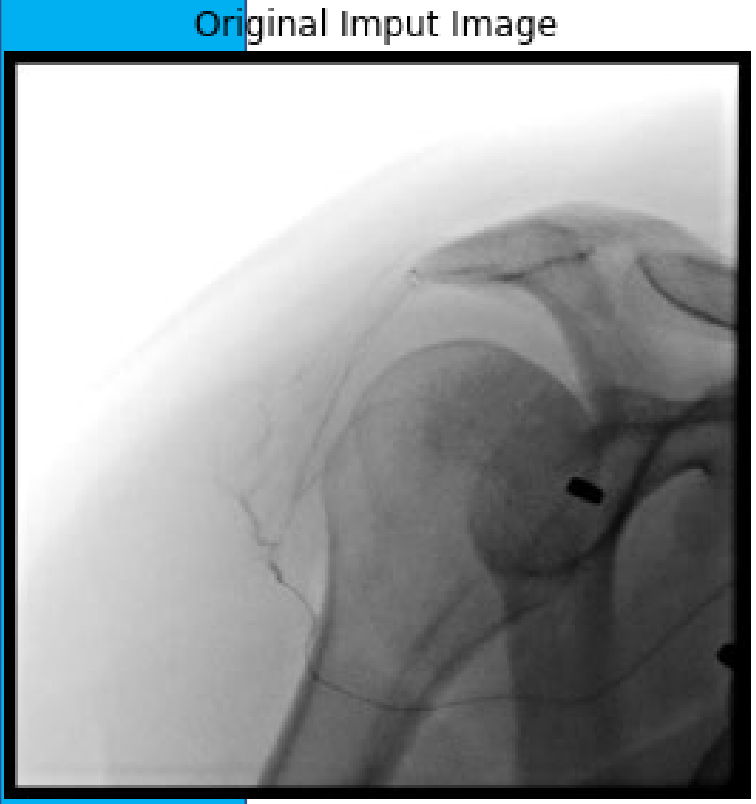
C.

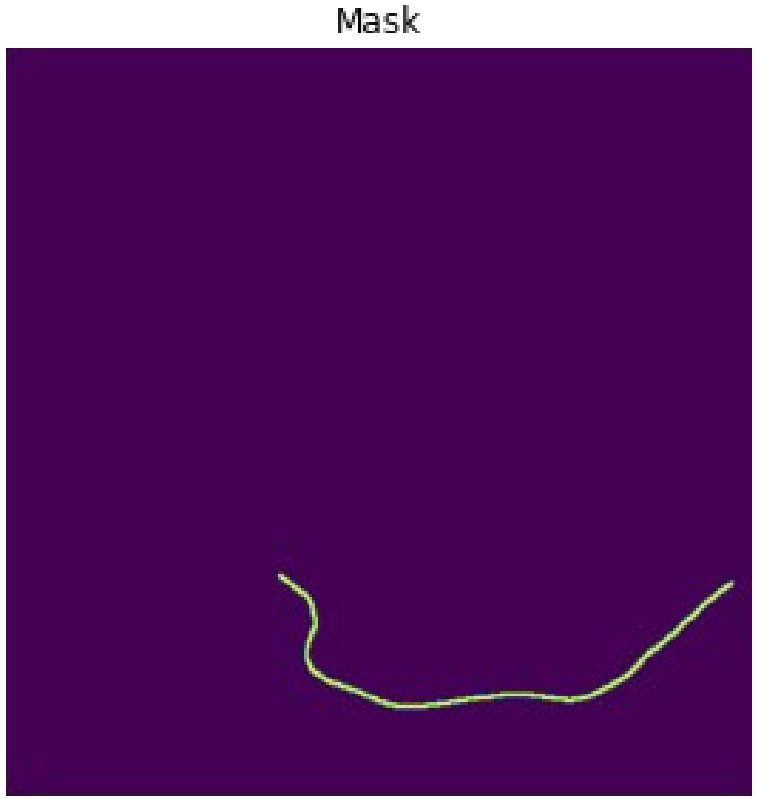
Compréhension du *trajet vasculaire*

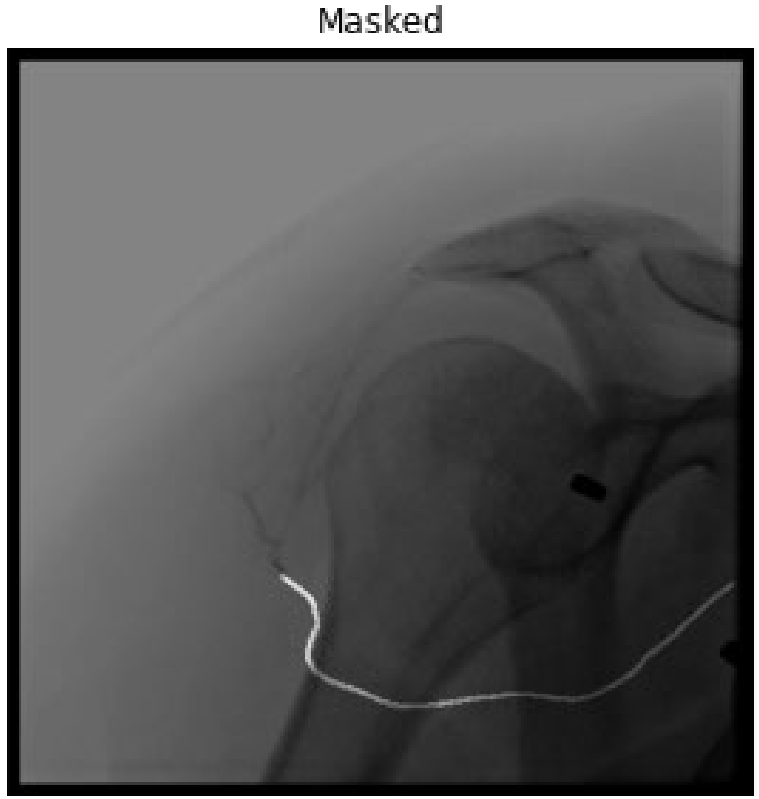
Analyse de l'arborescence vasculaire, navigation, détection d'anomalie

Université Paris Cité

Au commencement… une tâche







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Au commencement… une tâche

Masters 2

Philippine Cordelle
Julien Nguyen
Alisa Kugusheva
Clementine Lauvergne
Mohammed Bhalil
Emilio Picard

Bilan

150 patients
500 images segmentées
3 années (MVA)
7 modèles
En cours de validation externe

Université Paris Cité

Au commencement… une tâche

Frame-by-frame automatic device segmentation during fluoroscopy: proof-of-concept model towards real time segmentation for interventional radiology

Clémentine Lauvergne
Emilio Picard
Dr. Tom Boeken
Julien Nguyen Van
Alisha Kugusheva
Marc Sapoval
Jean Feydy
Stéphanie Allassonniere

Université Paris Cité

Au commencement… une tâche

\#	Models	mIoU	Dice Metric
1	Baseline (UNet)	0.40	0.48
2	NN-UNet	0.49	0.58
3	MedSAM	**0.57**	**0.72**

Comparison of models performance on mIoU and Dice metrics on test dataset.

table:results

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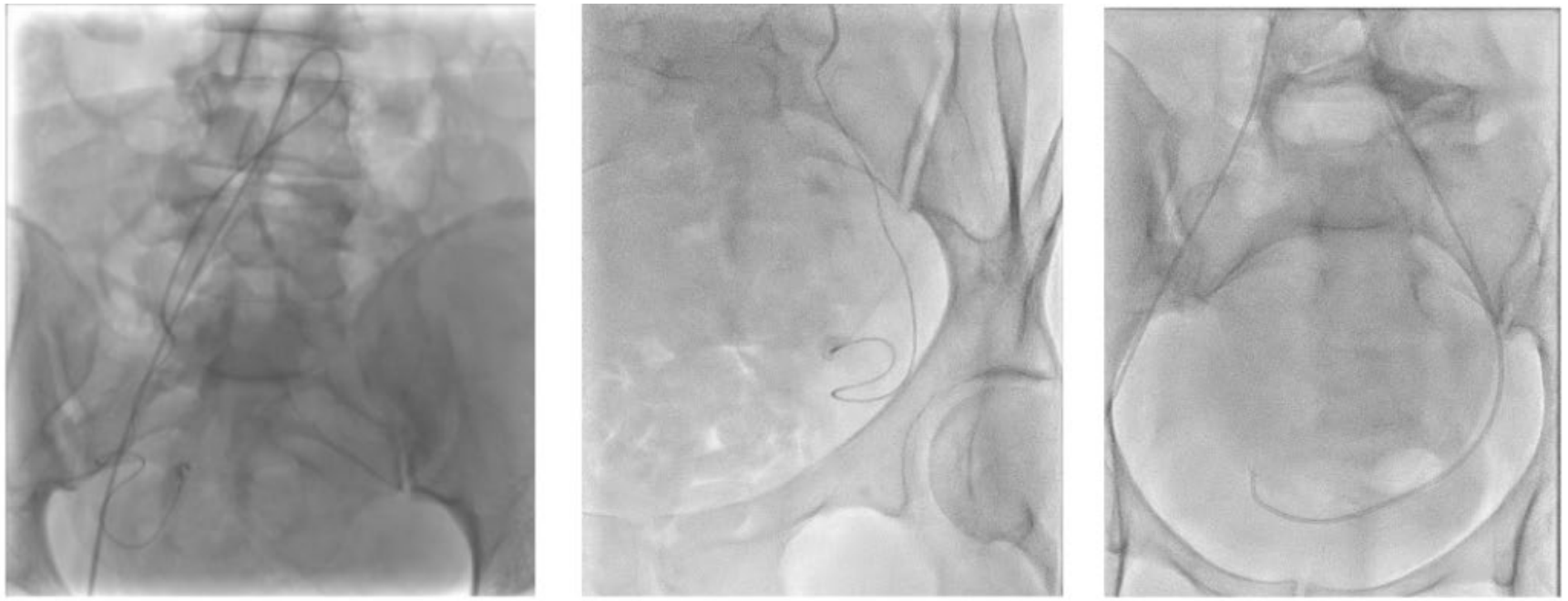
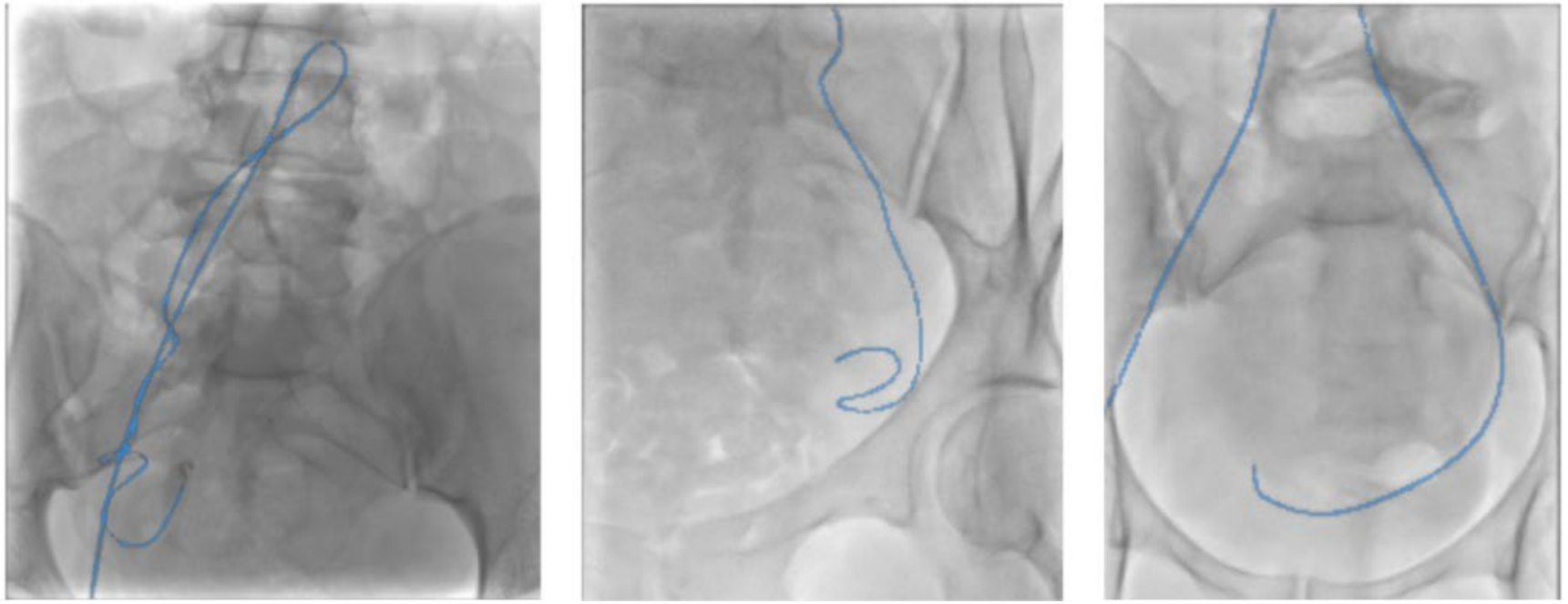
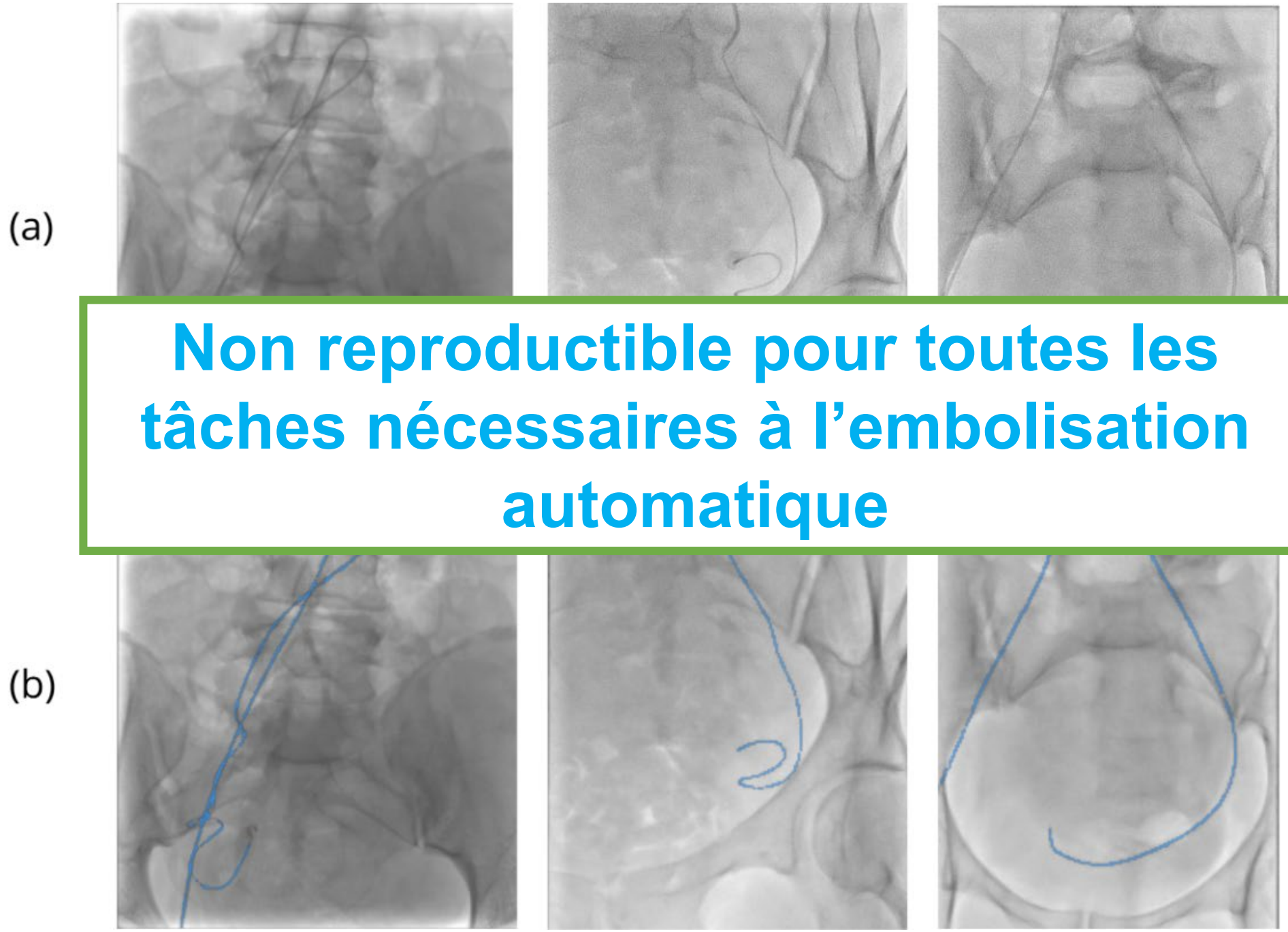
(a)



(b)



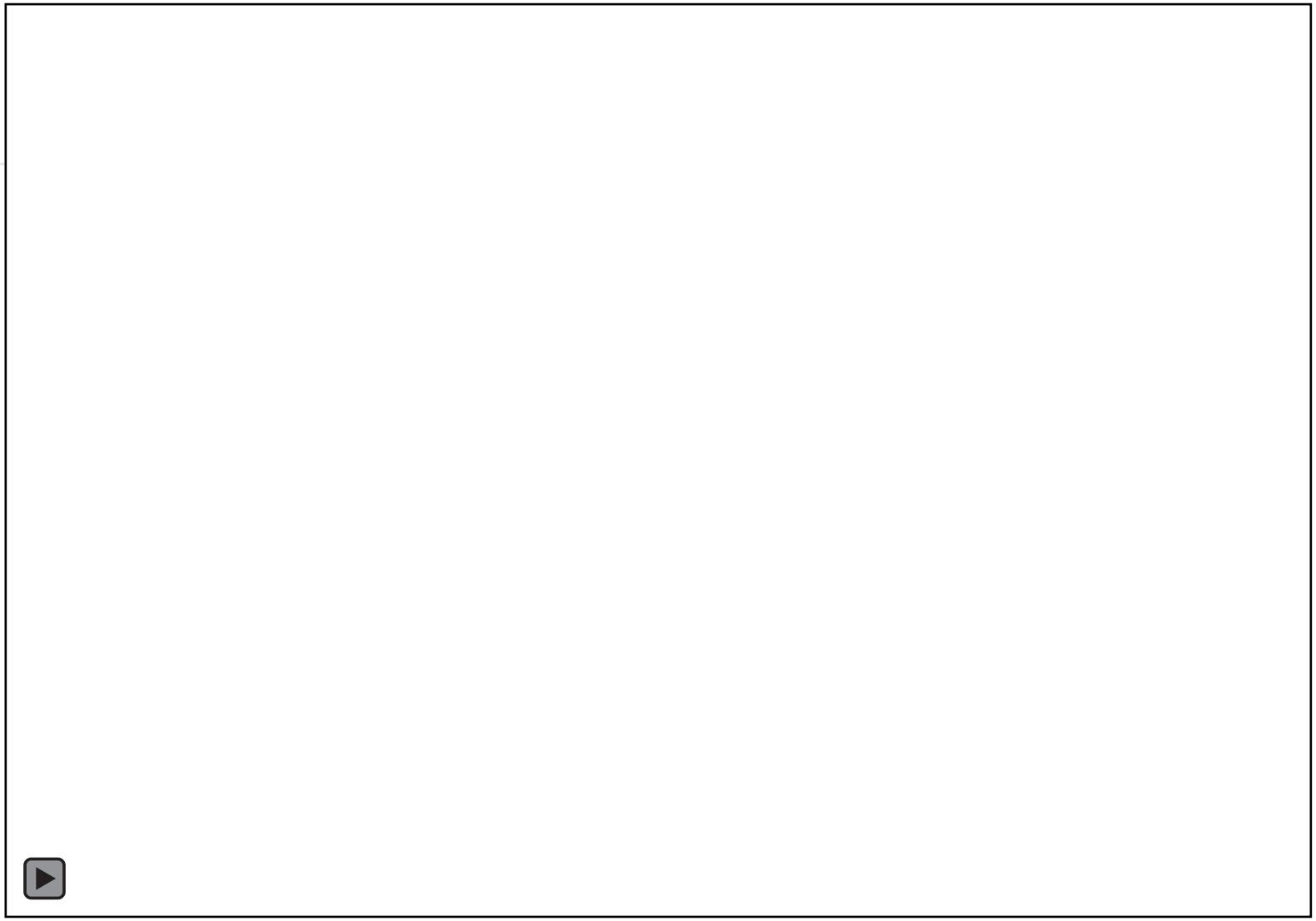


Non reproductible pour toutes les tâches nécessaires à l'embolisation automatique

Click prompt

Segment Anything

Research by Meta AI



Bounding box prompt

Segment Anyth

Research by Meta AI

What is happening today

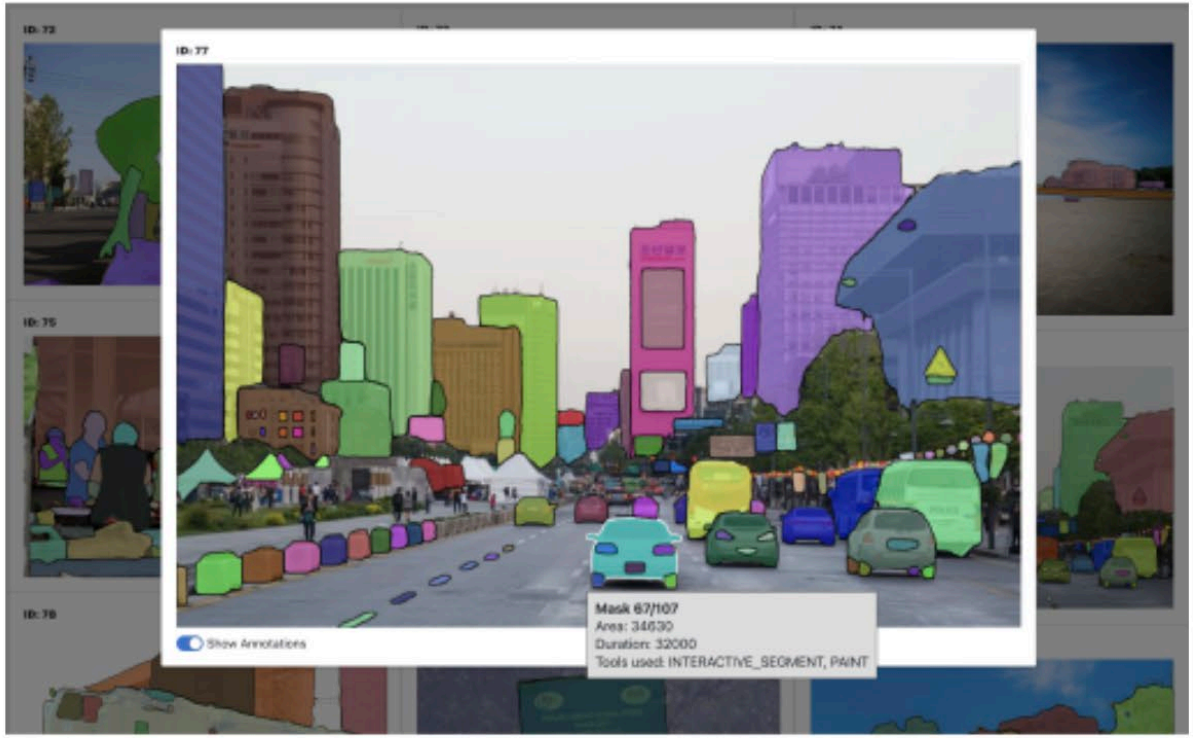
Segment Anything

Research by Meta AI

11M images, 1B+ masks

After annotating enough masks with SAM's help, we were able to leverage SAM's sophisticated ambiguity-aware design to annotate new images fully automatically. To do this, we present SAM with a grid of points on an image and ask SAM to segment everything at each point. Our final dataset includes more than 1.1 billion segmentation masks collected on ~11 million licensed and privacy preserving images.

Explore the dataset **Download full dataset**



Foundation models explained

A foundation model is a **large** machine learning model that's trained on a very broad set of data—often massive and **diverse** enough to cover many domains, languages, and **tasks**—and that can then be adapted (**fine-tuned or prompted**) to perform many different **downstream applications.**

Foundation models explained

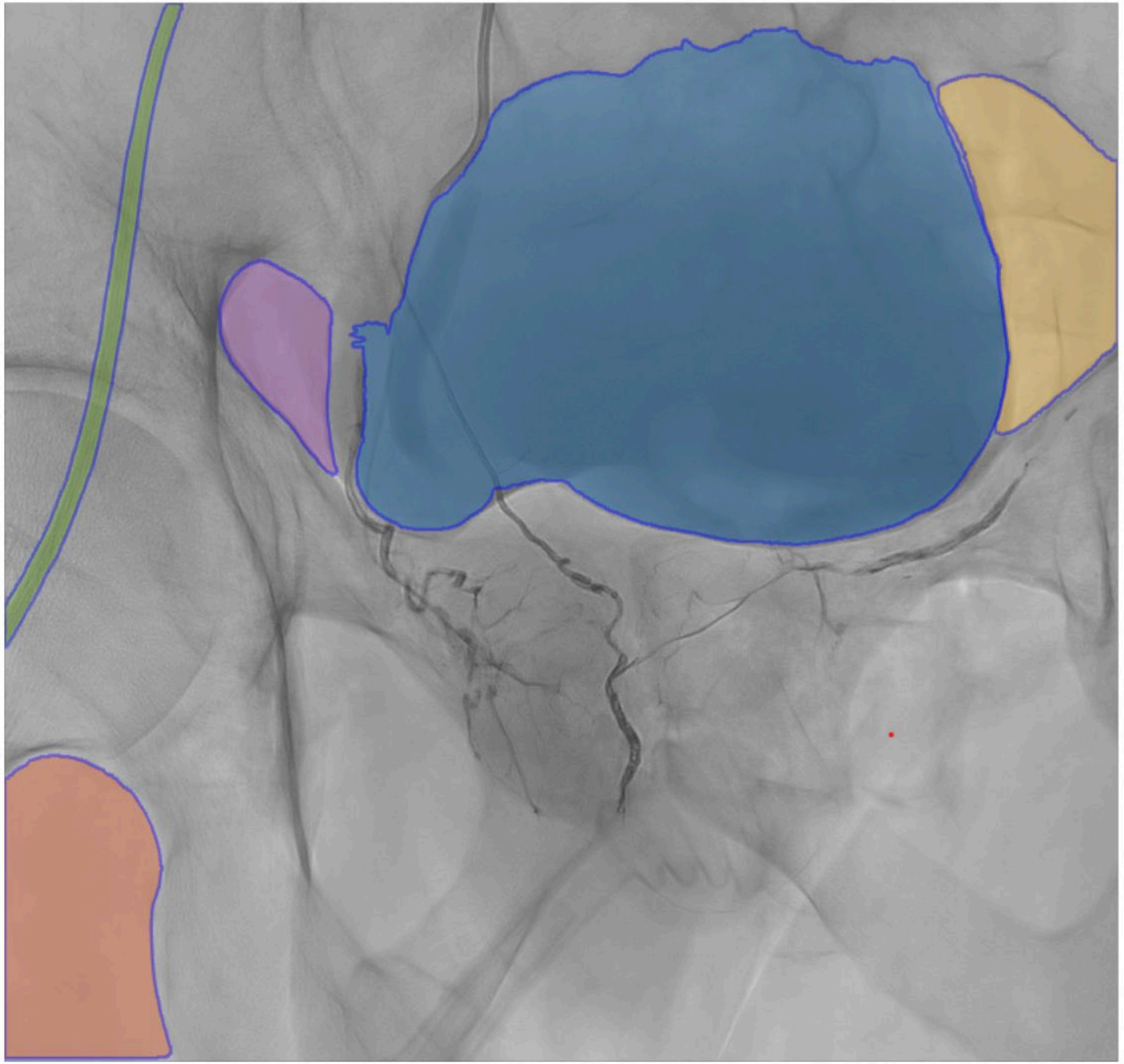
		Data amount
Standard models	nnUNet	~10
	ResNet	~100 / 1000
Foundation models	SAM	11 M
	Dinov2	142 M
	DALL-E	1 B

\+ Labels

Fine-tuning for specific IR tasks

Devices (catheter, micro)
=>for robotics

Liquid embolics
=>safety reflux detection, non target)
=>automation (choice of device, automatic injection)



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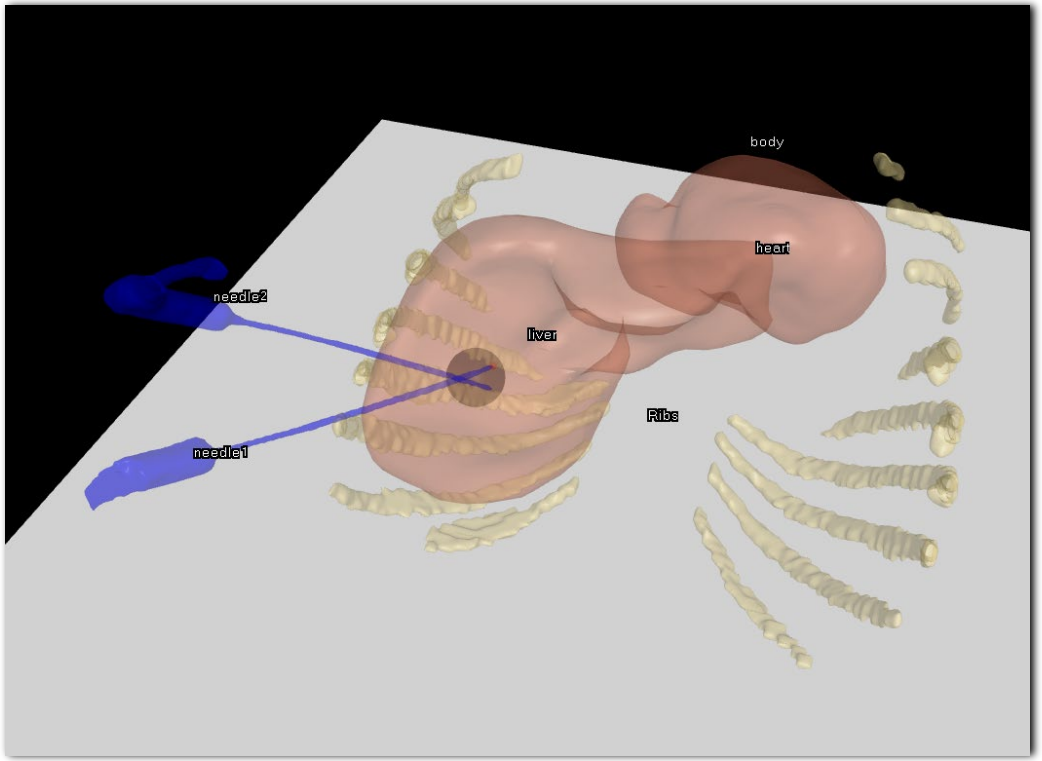
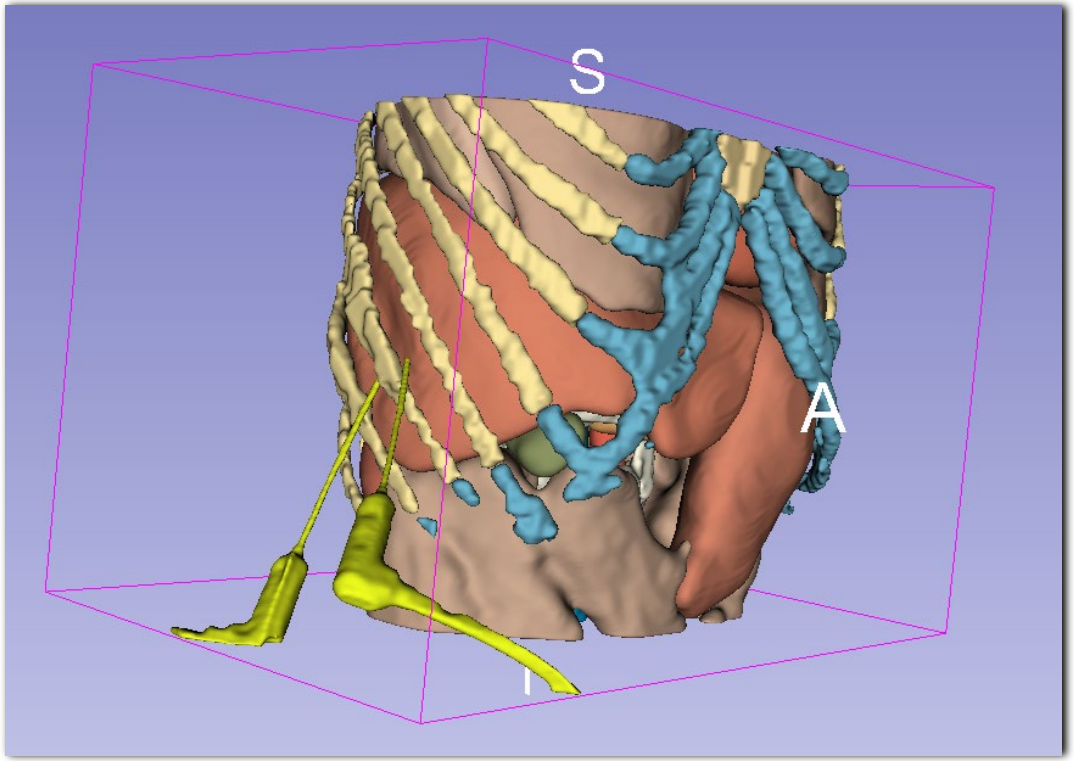
Tumor segmentation for IR

Tumor segmentation / margins



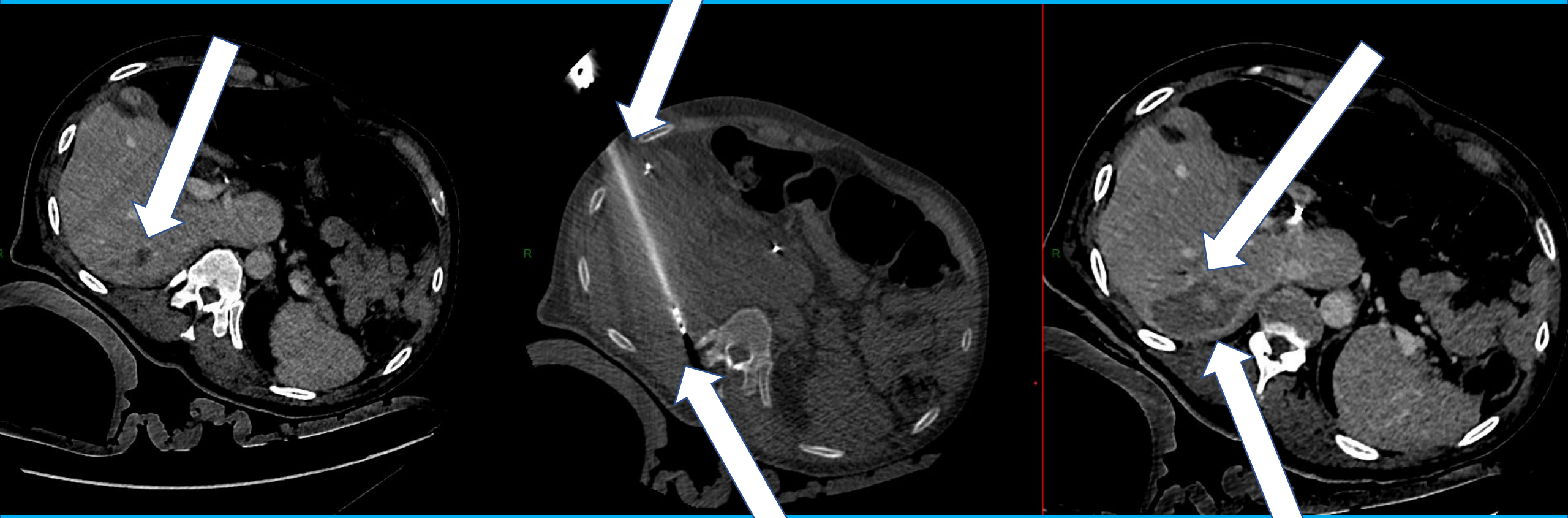
Device reconstruction/ robotics



Tumoral segmentation

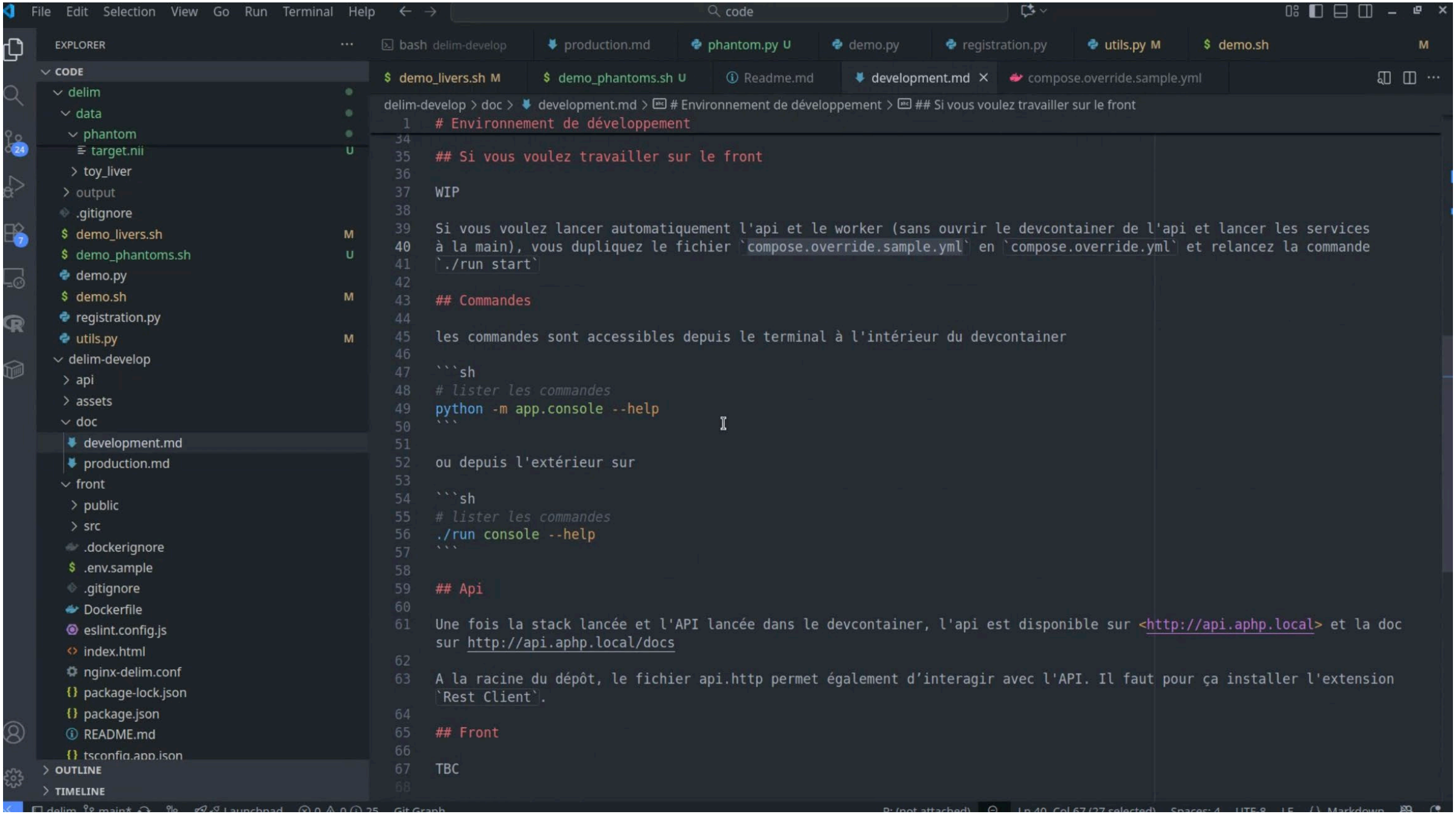
Trajectory optimization + energy delivery

Margin assessment and follow-up



Organ deformation + misregistration

Immediate tumor deformation (shrinkage+ ablation zone)

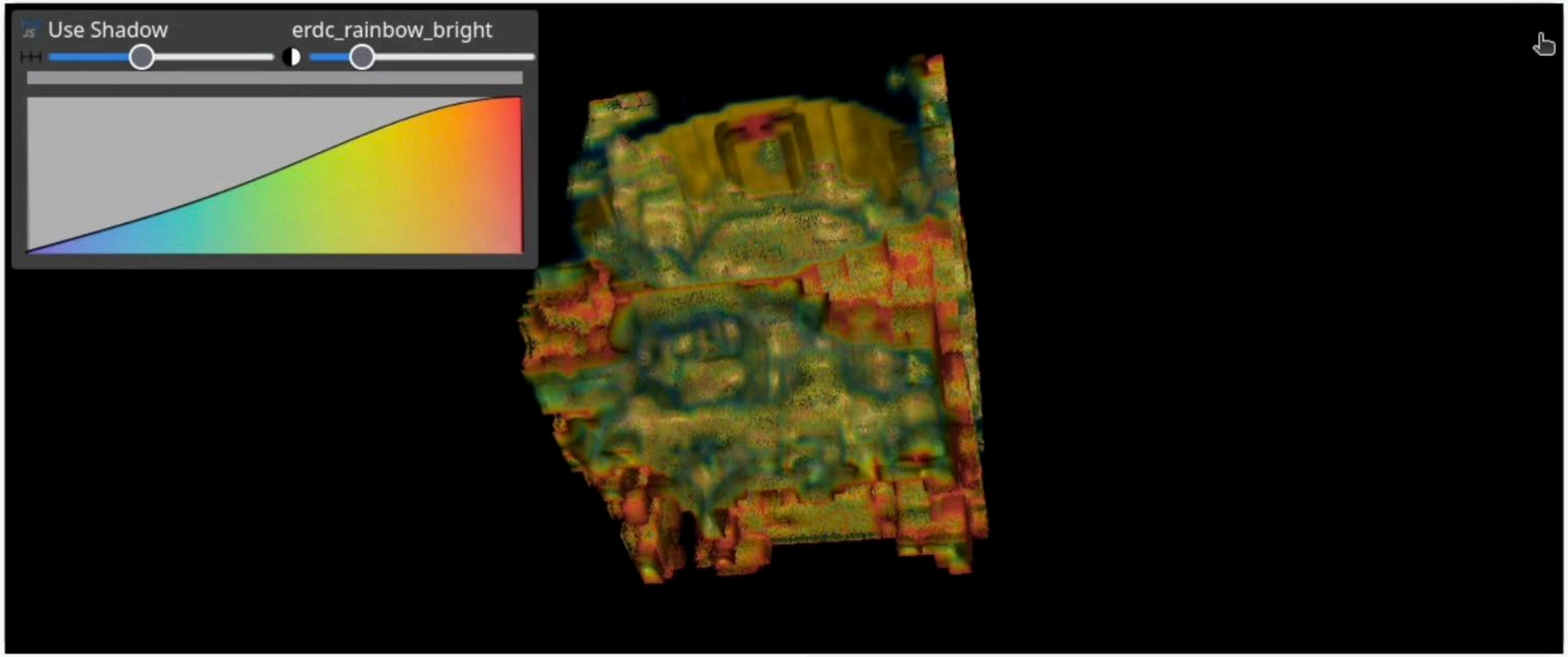

File Edit Selection View Go Run Terminal Help
code
EXPLORER
CODE
delim
data
phantom
target.nii
toy_liver
output
.gitignore
demo_livers.sh
demo_phantoms.sh
demo.py
demo.sh
registration.py
utils.py
delim-develop
api
assets
doc
development.md
production.md
front
public
src
.dockerignore
.env.sample
.gitignore
Dockerfile
eslint.config.js
index.html
nginx-delim.conf
package-lock.json
package.json
README.md
tsconfig.app.json
OUTLINE
TIMELINE
bash delim-develop
production.md
phantom.py U
demo.py
registration.py
utils.py M
demo.sh
demo_livers.sh M
demo_phantoms.sh U
Readme.md
development.md
compose.override.sample.yml
delim-develop > doc > development.md > # Environnement de développement > ## Si vous voulez travailler sur le front
1 # Environnement de développement
35 ## Si vous voulez travailler sur le front
37 WIP
39 Si vous voulez lancer automatiquement l'api et le worker (sans ouvrir le devcontainer de l'api et lancer les services
40 à la main), vous dupliquez le fichier `compose.override.sample.yml` en `compose.override.yml` et relancez la commande
41 `./run start`
43 ## Commandes
45 les commandes sont accessibles depuis le terminal à l'intérieur du devcontainer
47 ```sh
48 # lister les commandes
49 python -m app.console --help
50 ```
52 ou depuis l'extérieur sur
54 ```sh
55 # lister les commandes
56 ./run console --help
57 ```
59 ## Api
61 Une fois la stack lancée et l'API lancée dans le devcontainer, l'api est disponible sur <http://api.aphp.local> et la doc
sur http://api.aphp.local/docs
63 A la racine du dépôt, le fichier api.http permet également d'interagir avec l'API. Il faut pour ça installer l'extension
`Rest Client`.
65 ## Front
67 TBC

DELIM
APHP

Lorem ipsum dolor sit amet, consectetur adipiscing elit. Nam congue orci at arcu hendrerit, ut faucibus leo faucibus. Maecenas sit amet felis enim. Nam ullamcorper tempor vestibulum

Nouvelle analyse

Fichier de référence



Oncopilot, le RECIST AI

Partenariat avec Raidium pour intégrer Oncopilot dans le workflow RI

npj | precision oncology

Article

Published in partnership with The Hormel Institute, University of Minnesota

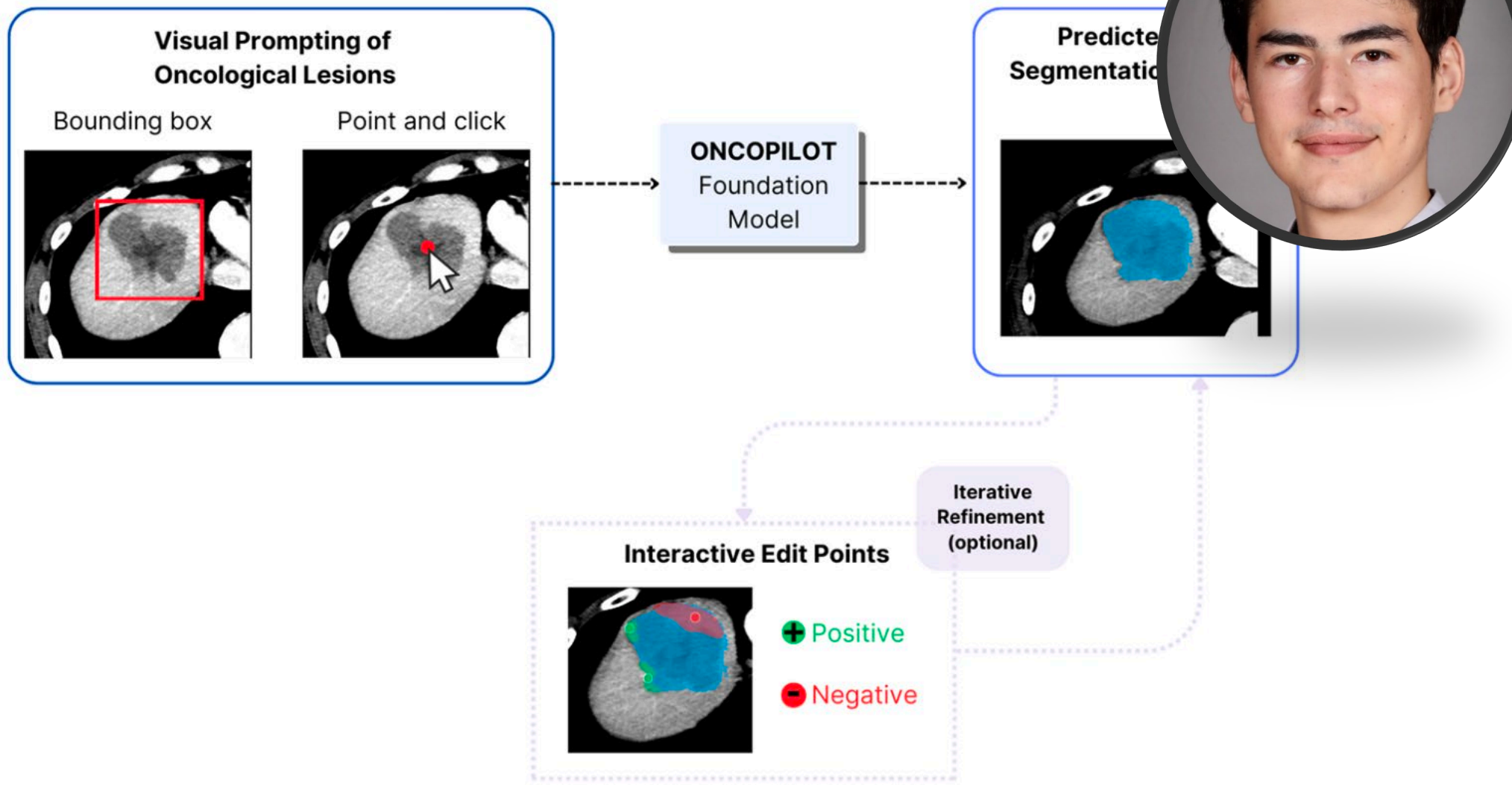
https://doi.org/10.1038/s41698-025-00903-y

A promptable CT foundation model for solid tumor evaluation

Léo Machado[1,2], Léo Alberge[1], Hélène Philippe[1,2,3], Elodie Ferreres[1], Julien Khlaut[1,4], Julie Dupuis[1], Korentin Le Floch[1,4], Denis Habip Gatenyo[5], Pascal Roux[6], Jules Grégory[2,3], Maxime Ronot[2,3] ✉, Corentin Dancette[1], Tom Boeken[4], Daniel Tordjman[1], Pierre Manceron[1] & Paul Hérent[1,6]

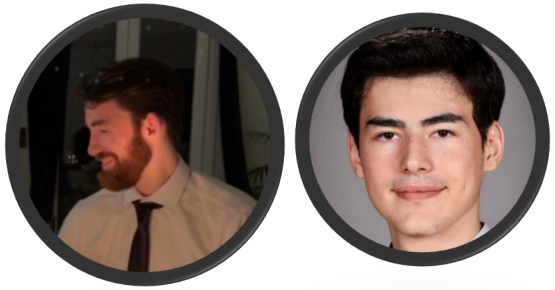
Carcinogenesis is inherently complex, resulting in heterogeneous tumors with variable outcomes and frequent metastatic potential. Conventional longitudinal evaluation methods like RECIST 1.1 remain labor-intensive and prone to measurement errors, while existing AI solutions face critical limitations due to tumor heterogeneity, insufficient annotations, and lack of user interaction. We developed ONCOPILOT, an interactive CT-based foundation model dedicated to 3D tumor segmentation, significantly refining RECIST 1.1 evaluations with active radiologist engagement. Trained on more than 8000 CT scans, ONCOPILOT employs intuitive visual prompts, including point-click, bounding boxes, and edit-points. It attains segmentation accuracy that matches or exceeds state-of-the-art methods, provides radiologist-level precision for RECIST 1.1 measurements, reduces inter-observer variability, and enhances workflow efficiency. Integrating clinical expertise with interactive AI capabilities, ONCOPILOT facilitates widespread access to advanced biomarkers, notably volumetric tumor analyses, thereby supporting improved clinical decision-making, patient stratification, and accelerating advancements in oncology research.

B


Visual Prompting of Oncological Lesions
Bounding box
Point and click
ONCOPILOT Foundation Model
Predicte
Segmentatio
Iterative Refinement (optional)
Interactive Edit Points
Positive
Negative

Exemple d'application :
Embolie pulmonaire massive

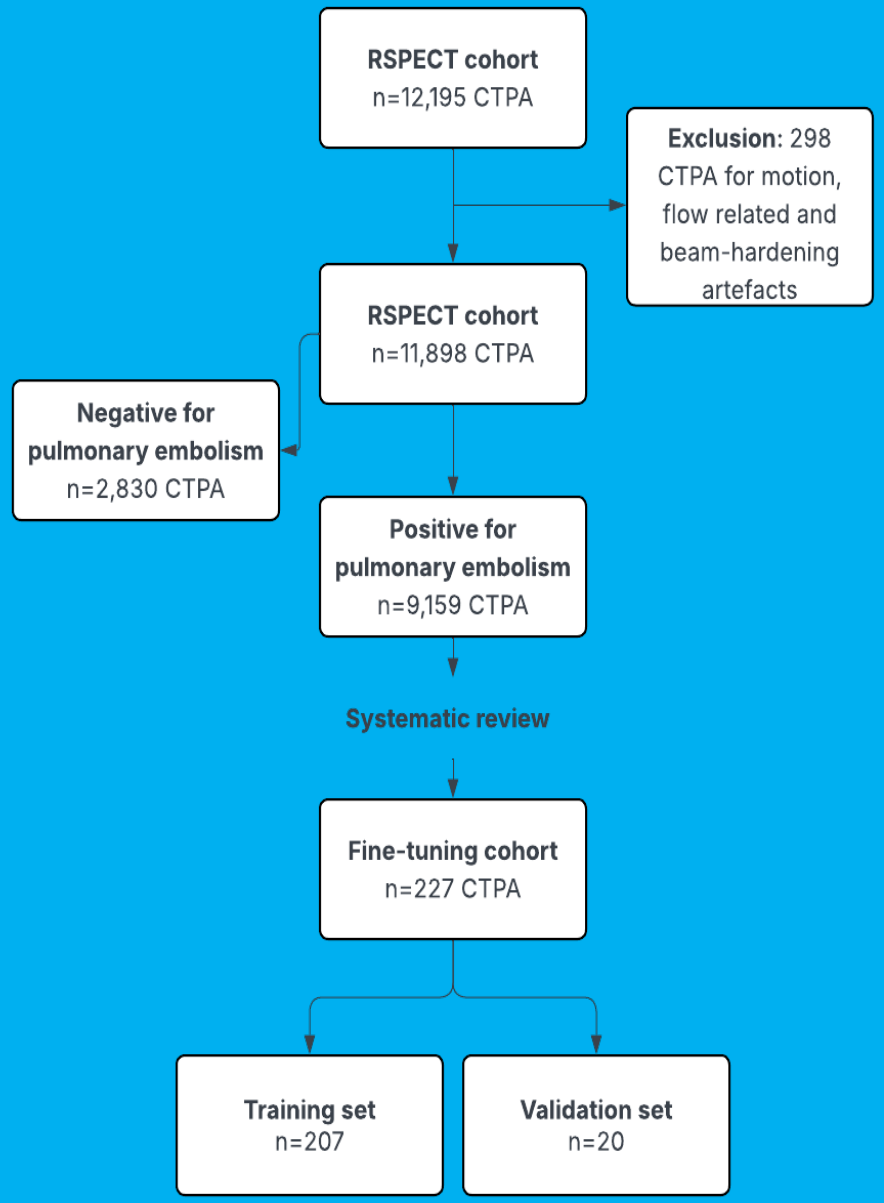
Ségmentation
Volumétrie
Gravité



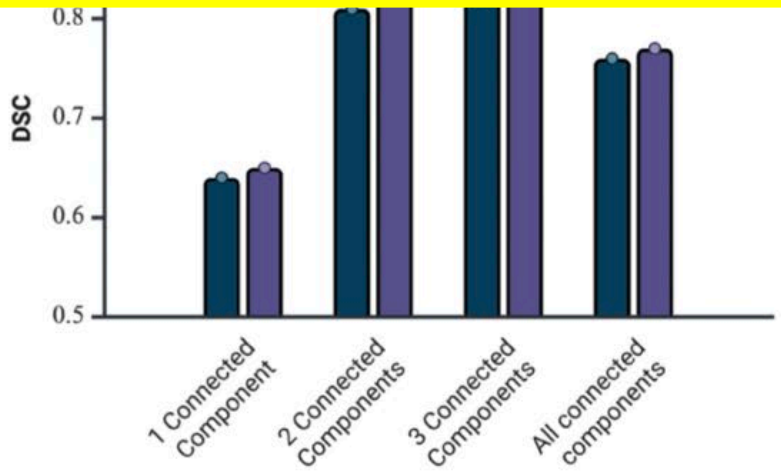
A promptable 3D-CT foundation model approach for pulmonary embolism

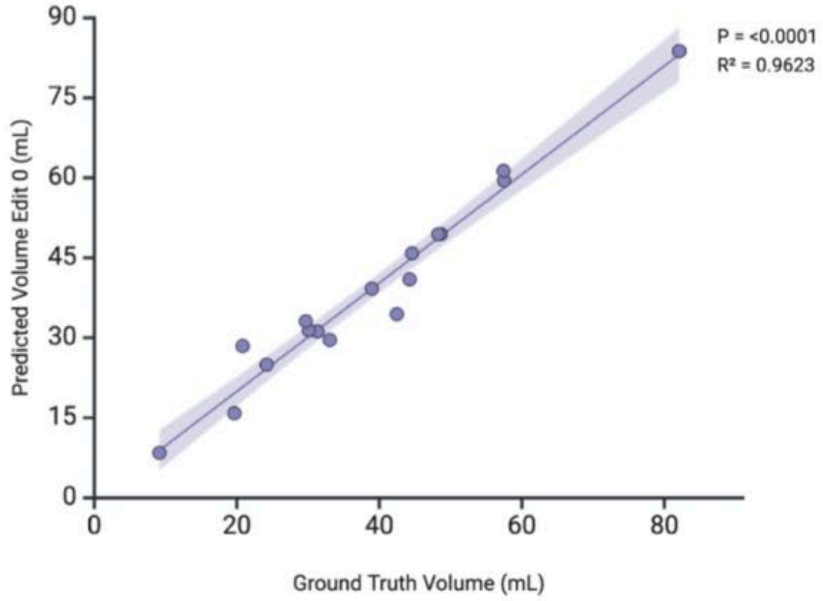
K. Le Floch[1], J. Khlaut[2], A. Prat [2],D. Tordjman[2], L. Aberge[2], L. Machado[2], X. Guerra[1], P. Manceron[2], P. Hérent[2] , M. Sapoval[1], T. Boeken[1]

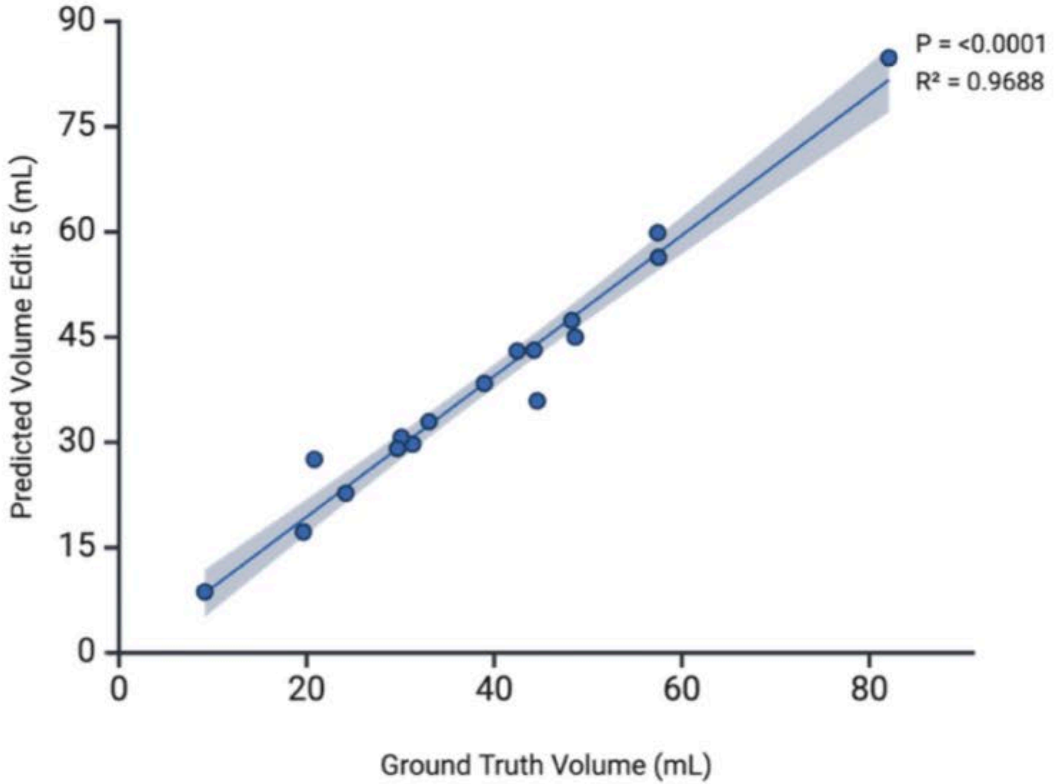
1. Department of Vascular and Oncological Interventional Radiology, Hôpital Européen Georges Pompidou, Paris, France; Université Paris Cité, Faculté de Médecine, 75006, Paris, France, HeKA, INRIA Paris.
2. Raidium, Paris Biotech santé, Paris, France


RSPECT cohort
n=12,195 CTPA
Exclusion: 298 CTPA for motion, flow related and beam-hardening artefacts
RSPECT cohort
n=11,898 CTPA
Negative for pulmonary embolism
n=2,830 CTPA
Positive for pulmonary embolism
n=9,159 CTPA
Systematic review
Fine-tuning cohort
n=227 CTPA
Training set
n=207
Validation set
n=20

CLOT BURDEN


DSC
0.8
0.7
0.6
0.5
1 Connected Component
2 Connected Components
3 Connected Components
All connected components


P = <0.0001
R² = 0.9623
Predicted Volume Edit 0 (mL)
Ground Truth Volume (mL)
0
15
30
45
60
75
90
0
20
40
60
80


P = <0.0001
R² = 0.9688
Predicted Volume Edit 5 (mL)
Ground Truth Volume (mL)
0
15
30
45
60
75
90
0
20
40
60
80

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Université Paris Cité

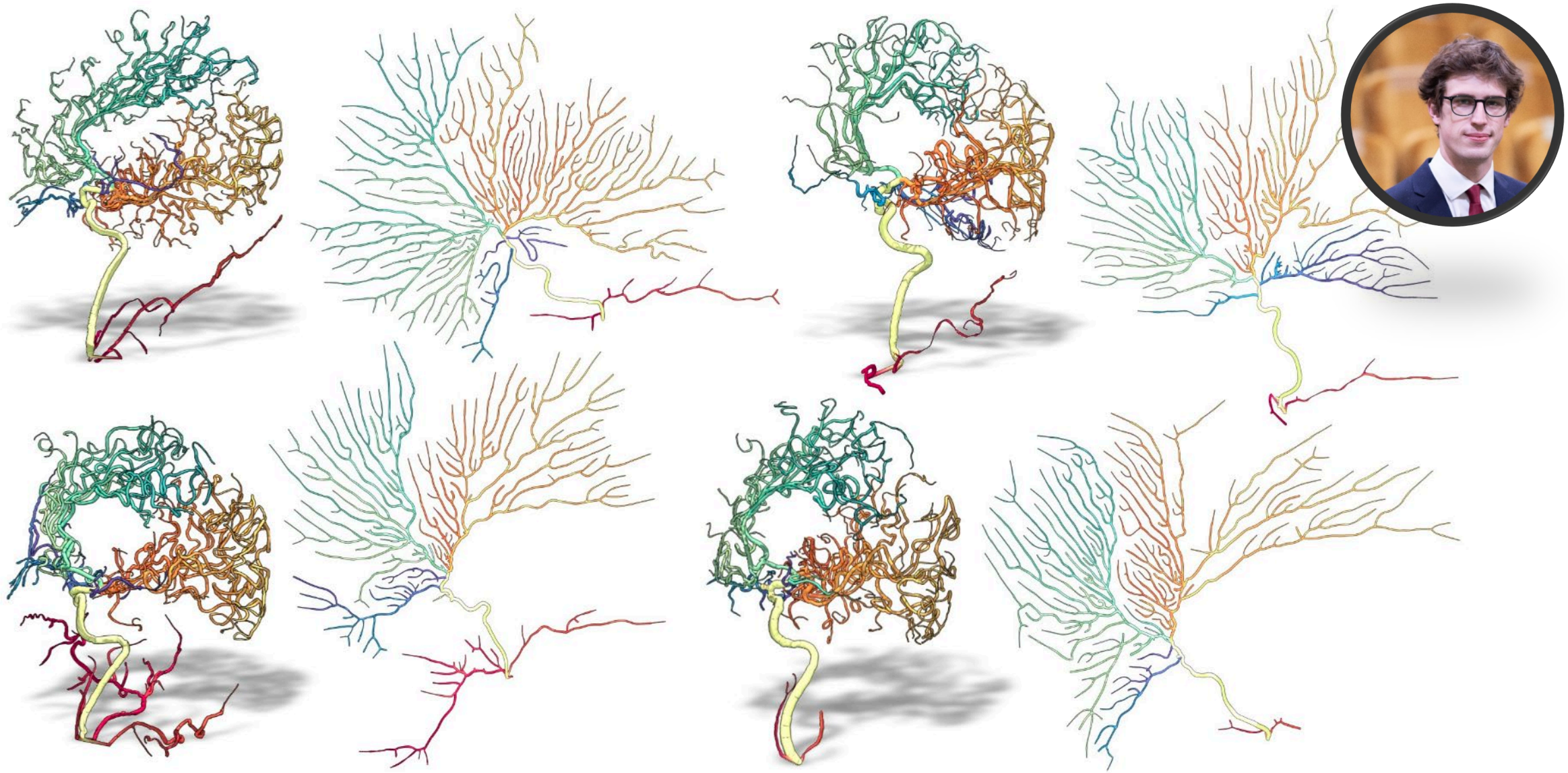
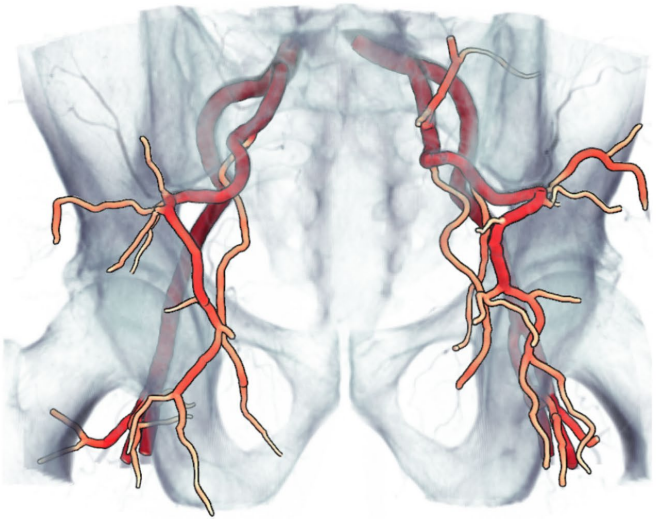
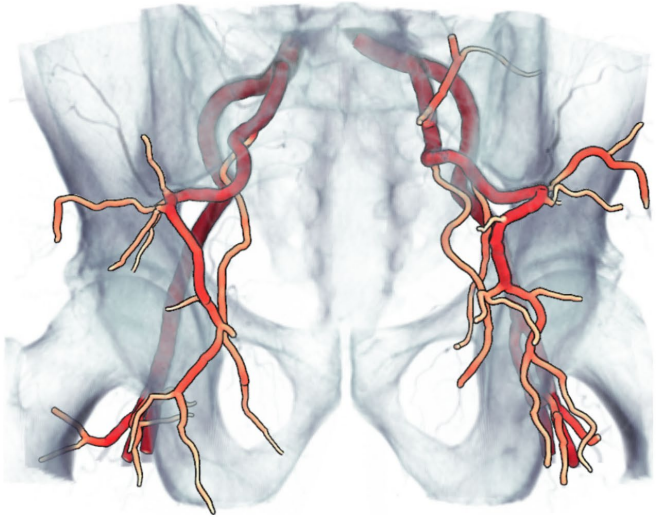
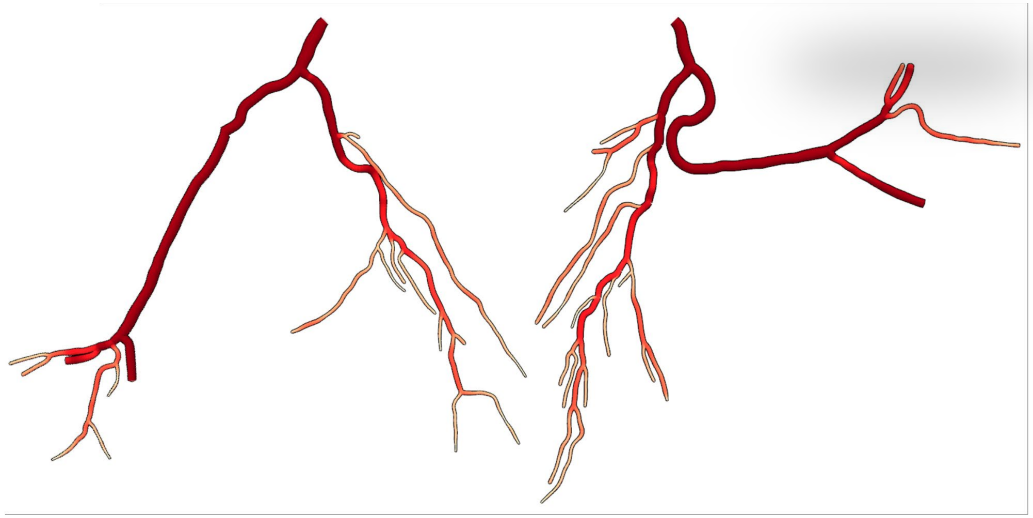


Fig. 7. Untangling four cerebral vascular trees that include the left carotid artery (yellow), anterior cerebral artery (green) and middle cerebral artery (orange).

PAE? Hemorroid? Bleeding?







Combined: democratizing « new » interventions such as GAE?

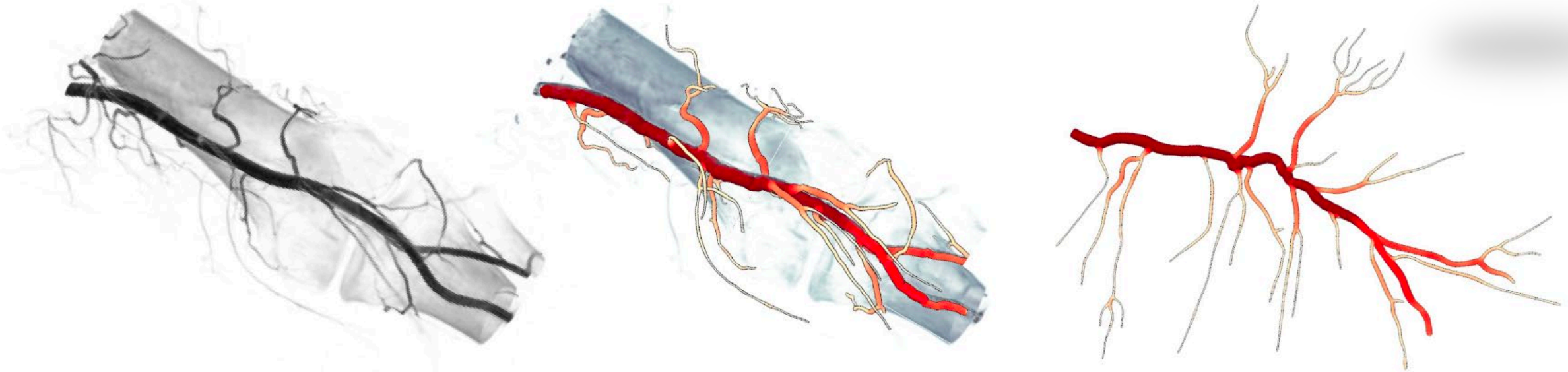
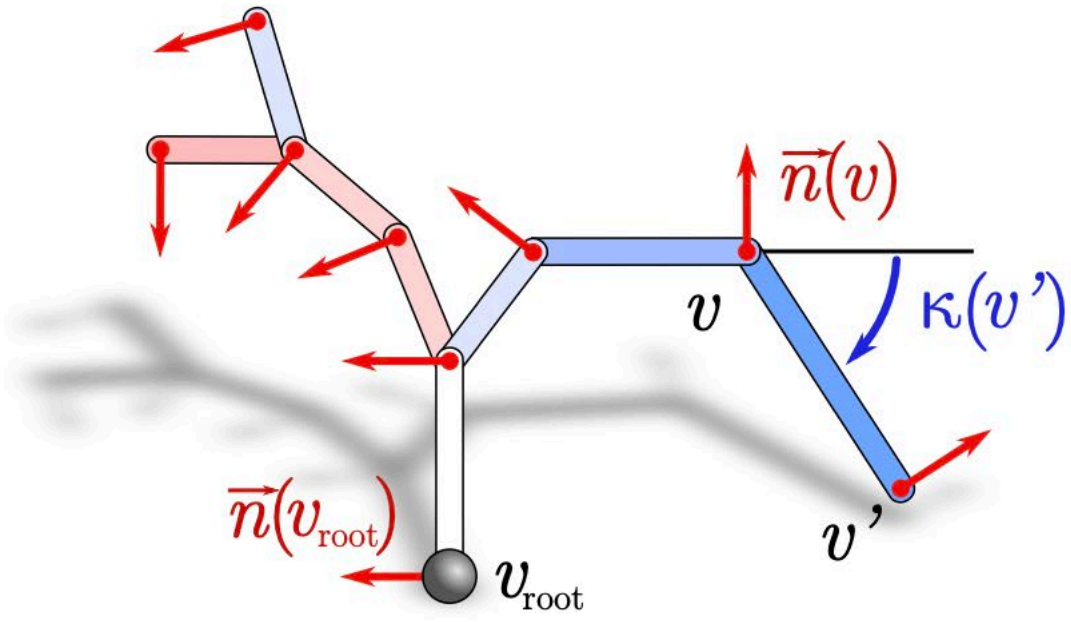
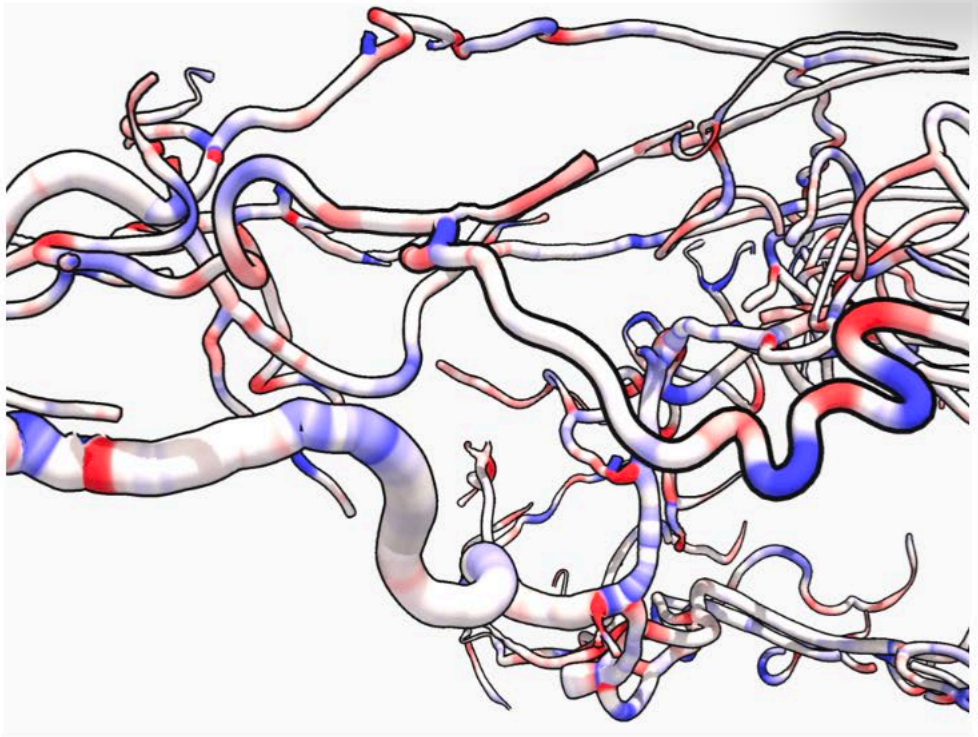


Fig. 8. *Left:* Three-dimensional angiography of the popliteal artery across the knee. *Middle:* Segmented artery tree, colored by the vessel radius. *Right:* Planar layout.

Curves: enhanced navigation and device selection





QUID DE LA PREDICTION / SELECTION DE PATIENTS?
GAE? PAE? Embolie pulmonaire?

Here is the challenge: non responders

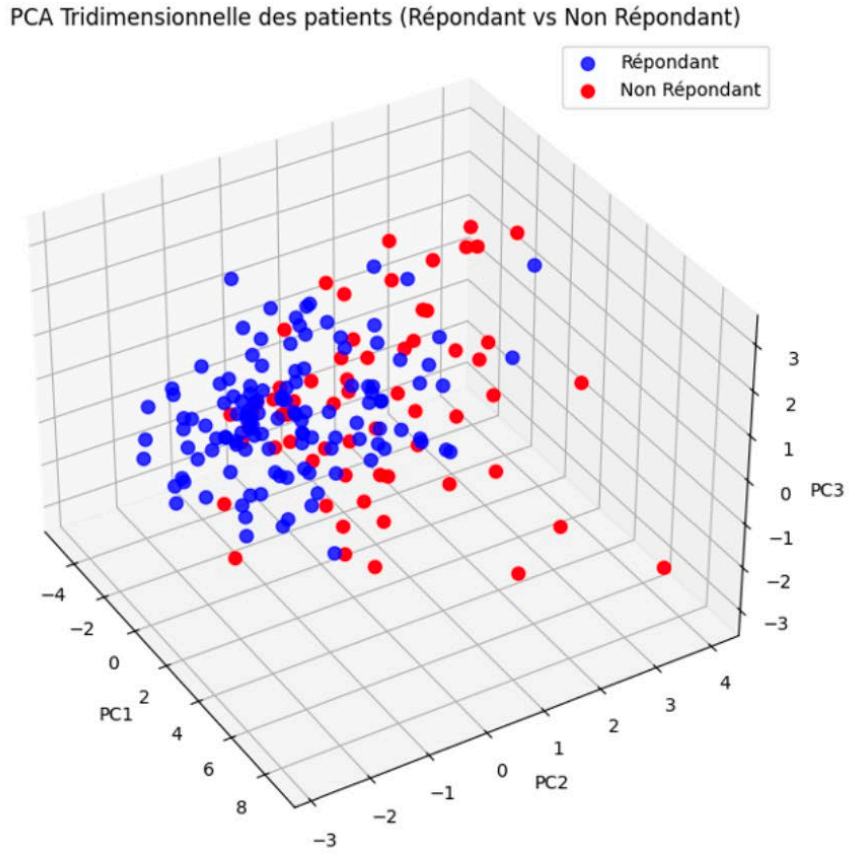


FIGURE 6.1 – PCA Tridimensionnelle des patients (Répondant vs Non Répondant)

3000 PAEs, no biomarker for non-responders

- Small prostate?
- Large prostate?
- Glandular / stromal subtype?
- Median lobe?
- Low IPSS? Medium QOL?
- Age? Smoker? High blood pressure? Diabetes?

Models, models, models

Model	Root MSE	R^2	Adj R^2	P-value train	Sensibilité	Spécificité
Ridge	5.75	0.36	0.26	1.09e-13	0.91	0.54
Lasso	5.60	0.35	-	1.40e-14	0.90	0.47
ElasticNet	5.60	0.35	-	1.40e-14	0.90	0.47
MLP	5.25	0.47	0.38	3.81e-24	0.86	0.67
XGBoost	6.20	0.20	-	7.40e-31	0.81	0.53
RandomForest	5.93	0.27	-	2.80e-25	0.79	0.53
AdaBoost	5.96	0.26	-	9.90e-38	0.74	0.53
SVR	5.95	0.32	0.21	3.11e-13	0.91	0.46

Cardiovasc Intervent Radiol (2024) 47:1248–1254
https://doi.org/10.1007/s00270-024-03776-z

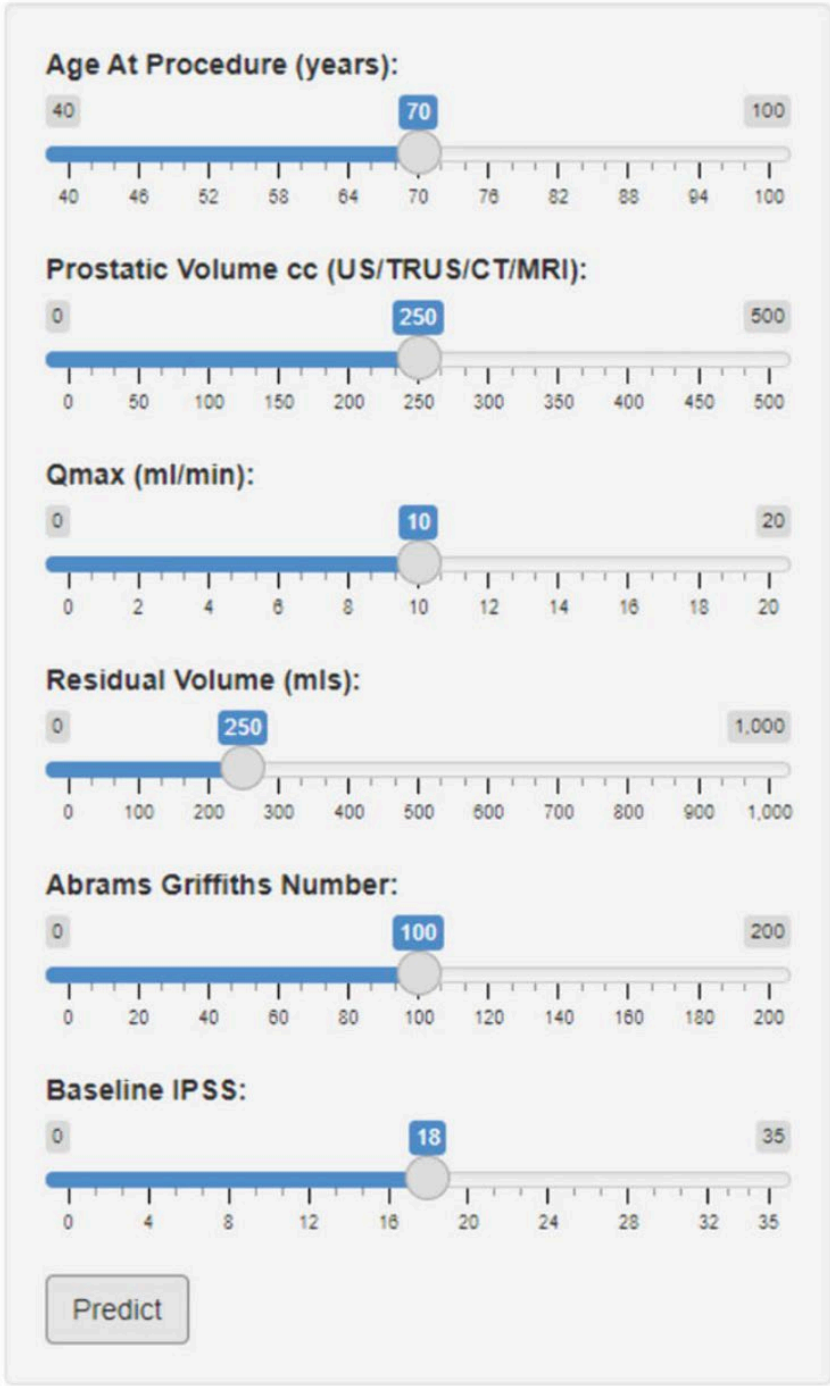
CIRSE

Check for updates

SCIENTIFIC PAPER (OTHER) EMBOLISATION (ARTERIAL)

Machine Learning to Predict Prostate Artery Embolization Outcomes

G. Vigneswaran[1,2] · N. Doshi[1,2] · D. Maclean[1] · T. Bryant[1] · M. Harris[3] · N. Hacking[1] · K. Farrahi[4] · M. Niranjan[4] · S. Modi[1]



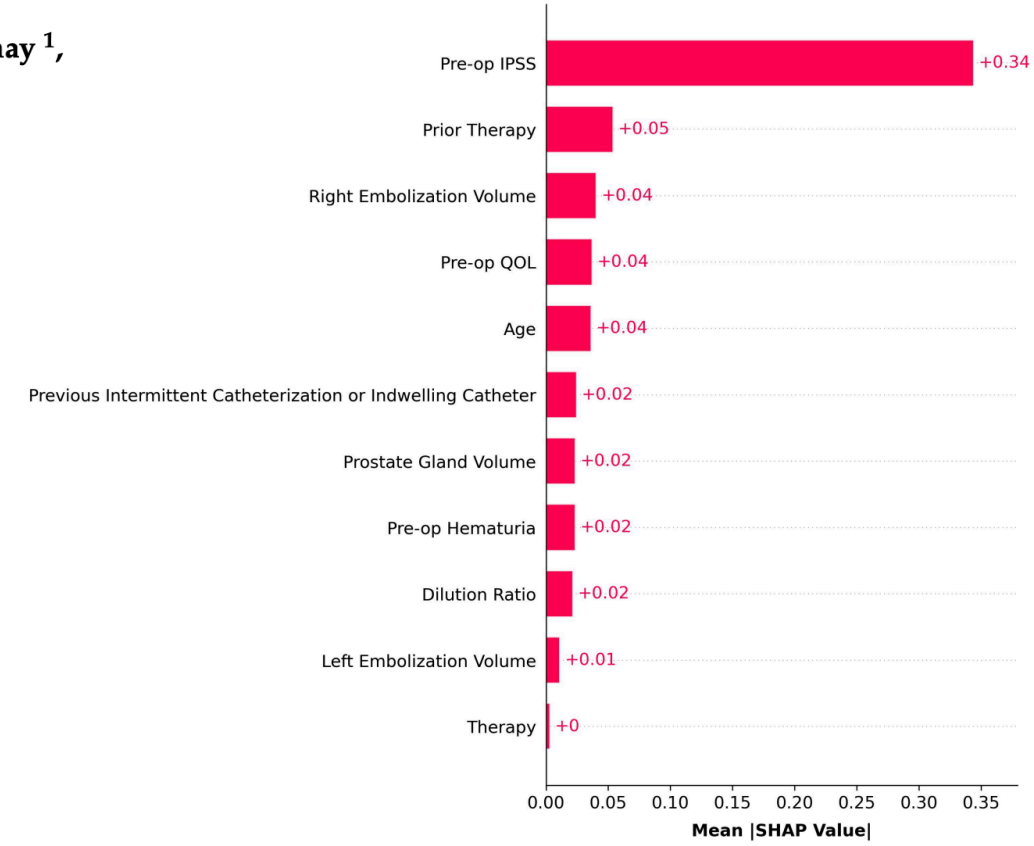
diagnostics

MDPI

Article

Predicting Early Outcomes of Prostatic Artery Embolization Using *n*-Butyl Cyanoacrylate Liquid Embolic Agent: A Machine Learning Study

Burak Berksu Ozkara [1], David Bamshad [1], Ramita Gowda [2], Mert Karabacak [3], Vivian Bishay [1], Kirema Garcia-Reyes [1], Ardeshir R. Rastinehad [4], Dan Shilo [1] and Aaron Fischman [1,*]



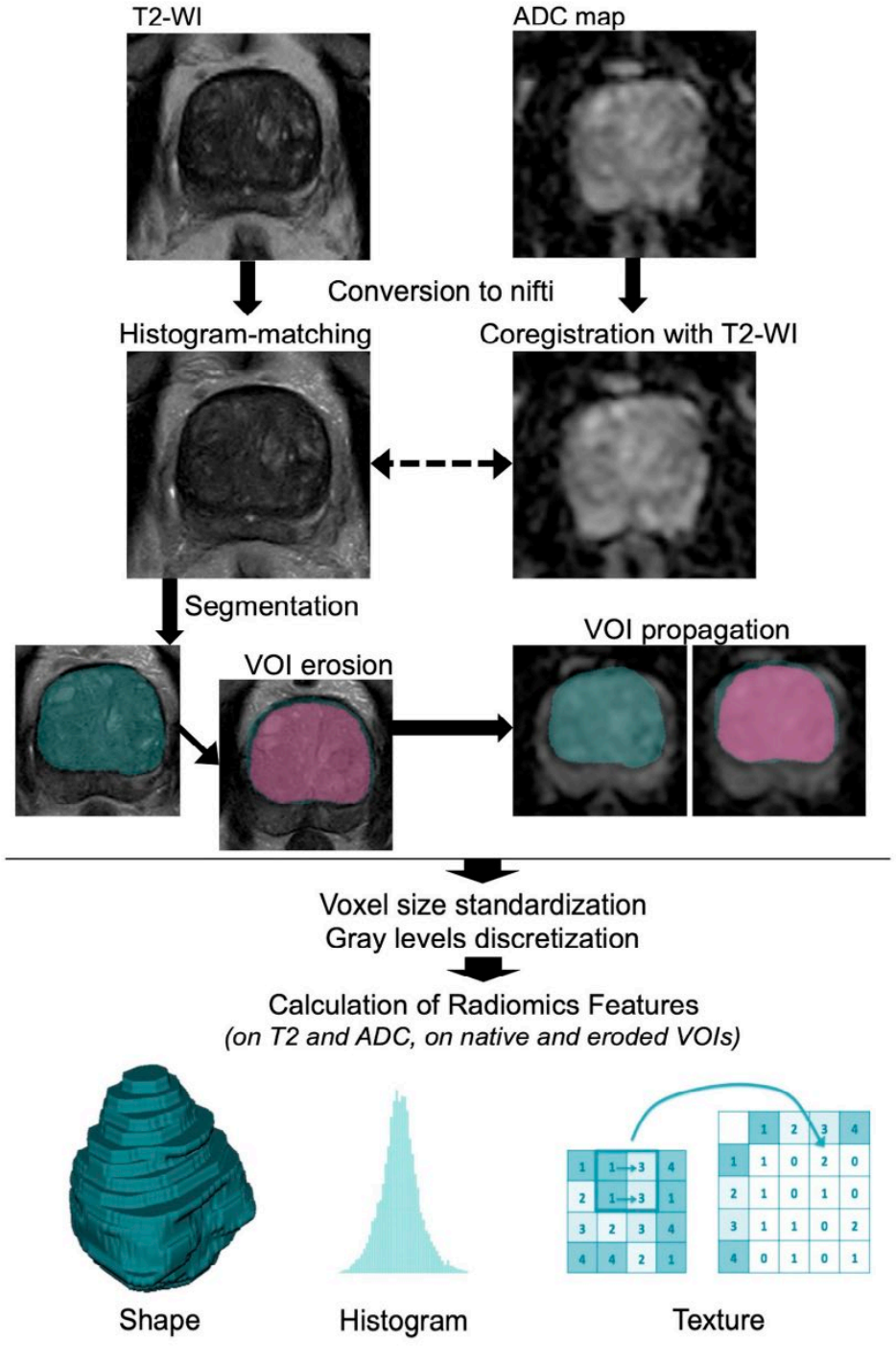
Journal of *Personalized Medicine*

MDPI

Article

Clinical, Technical, and MRI Features Associated with Patients' Outcome at 3 Months and 2 Years following Prostate Artery Embolization: Is There an Added Value of Radiomics?

Antoine Martin [1], Clément Marcelin [1,2], François Petitpierre [1,3], Eva Jambon [1], Rim Maaloum [1], Nicolas Grenier [1], Yann Le Bras [1] and Amandine Crombé [1,2,*]


T2-WI
ADC map
Conversion to nifti
Histogram-matching
Coregistration with T2-WI
Segmentation
VOI erosion
VOI propagation
Voxel size standardization
Gray levels discretization
Calculation of Radiomics Features
(on T2 and ADC, on native and eroded VOIs)
Shape
Histogram
Texture

Under construction

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CIRSE

Check for updates

COMMENTARY

COMMENTARY

Commentary on Machine Learning to Predict Prostate Artery Embolization Outcomes? Patient Selection for Prostatic Artery Embolization: Why it Matters

Tom Boeken[1]

Predicting the right outcome

<=>

Understanding the image???

MERCI!

FIRE 2025
Marseille
Novembre 2025

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