

## Apprentissage semi-supervisé pour la segmentation du réseau vasculaire cérébral : une étude comparative

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#### ▶ To cite this version:

Pierre Rougé, Nicolas Passat, Odyssée Merveille. Apprentissage semi-supervisé pour la segmentation du réseau vasculaire cérébral : une étude comparative. Colloque Français d'Intelligence Artificielle en Imagerie Biomédicale (IABM), Mar 2024, Grenoble, France. hal-04406684

#### HAL Id: hal-04406684 https://hal.science/hal-04406684v1

Submitted on 16 Apr 2024

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Annotations in the context of Semi-Supervised Learning

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**Guidelines for Cerebrovascular Segmentation: Managing Imperfect** 

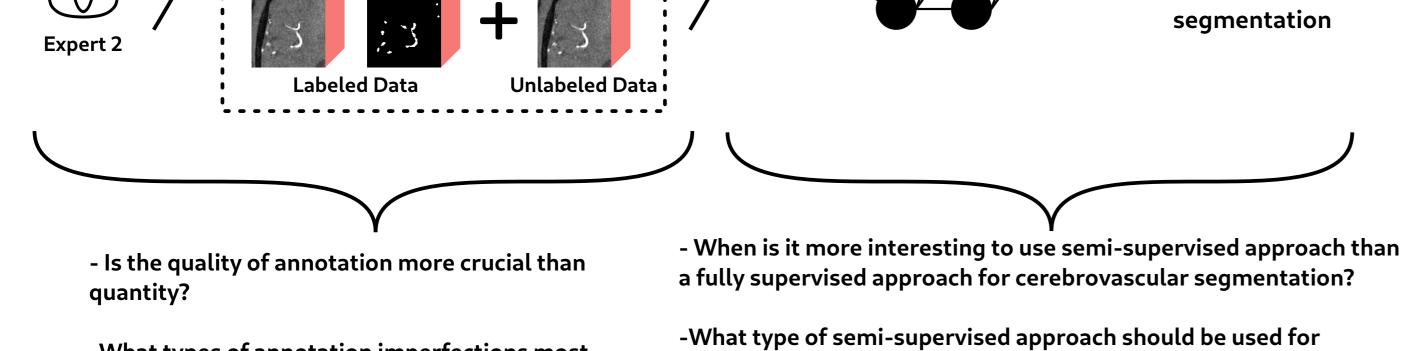


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### **Medical context** Annotation process Deep learning model Cerebrovascular dataset (8) Labeled Data Unlabeled Data **Concept Shif** Cerebrovascular

Exp. 2: Dependency to annotated data

- ► In low data regime scenario the risk of overfitting is very high and the performance of the model highly depends on the data used for training.
- ► The aim is to study the impact of the training data seed for semi-supervised and supervised method.

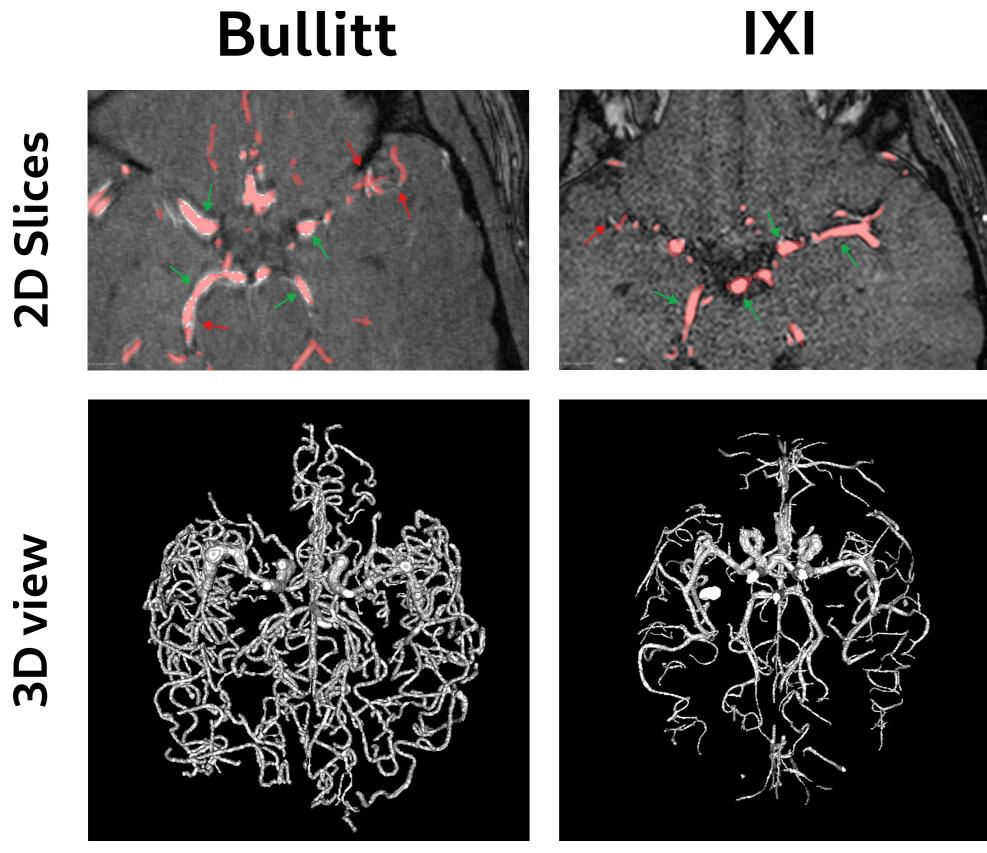


-What types of annotation imperfections most significantly degrade segmentation results and should be prioritarily avoided?

cerebrovascular segmentation?

-Can semi-supervised learning methods effectively mitigate overfitting on the annotated data they use?

Cerebrovascular annotations are time-consuming and error-prone. ► Also, no guidelines exist for cerebrovascular annotations. Thus, concept-shift between different dataset is a big bottleneck for the conception of robust segmentation methods.



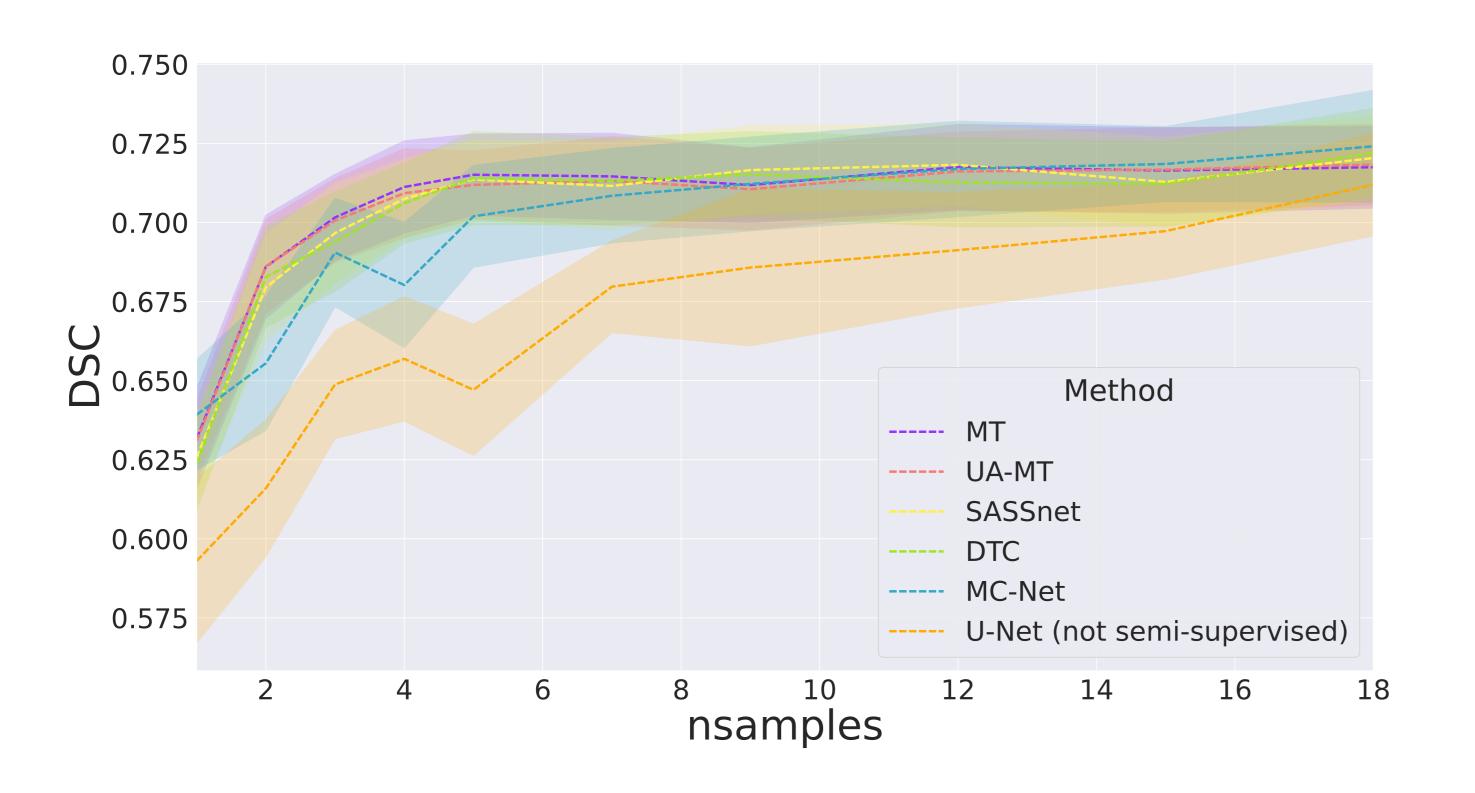
- 0.72 0.70 0.68 0.66 OSO 0.64 0.62 0.60 Method U-Net (not semi-supervised) 0.58 **UA-MT** 2 5 3 nsamples
- Semi-supervised methods highly reduce the variability between data seeds.

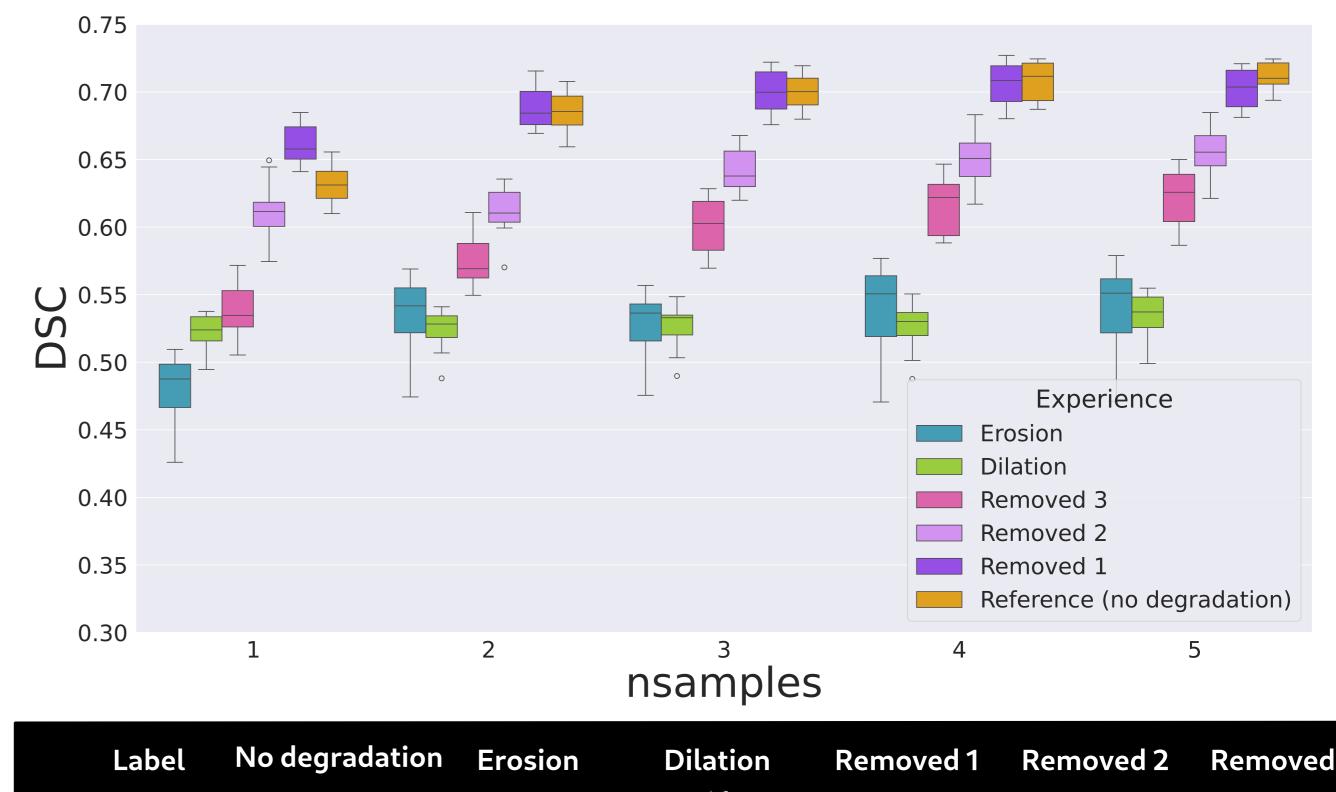
# Exp. 3: Impact of the annotation quality

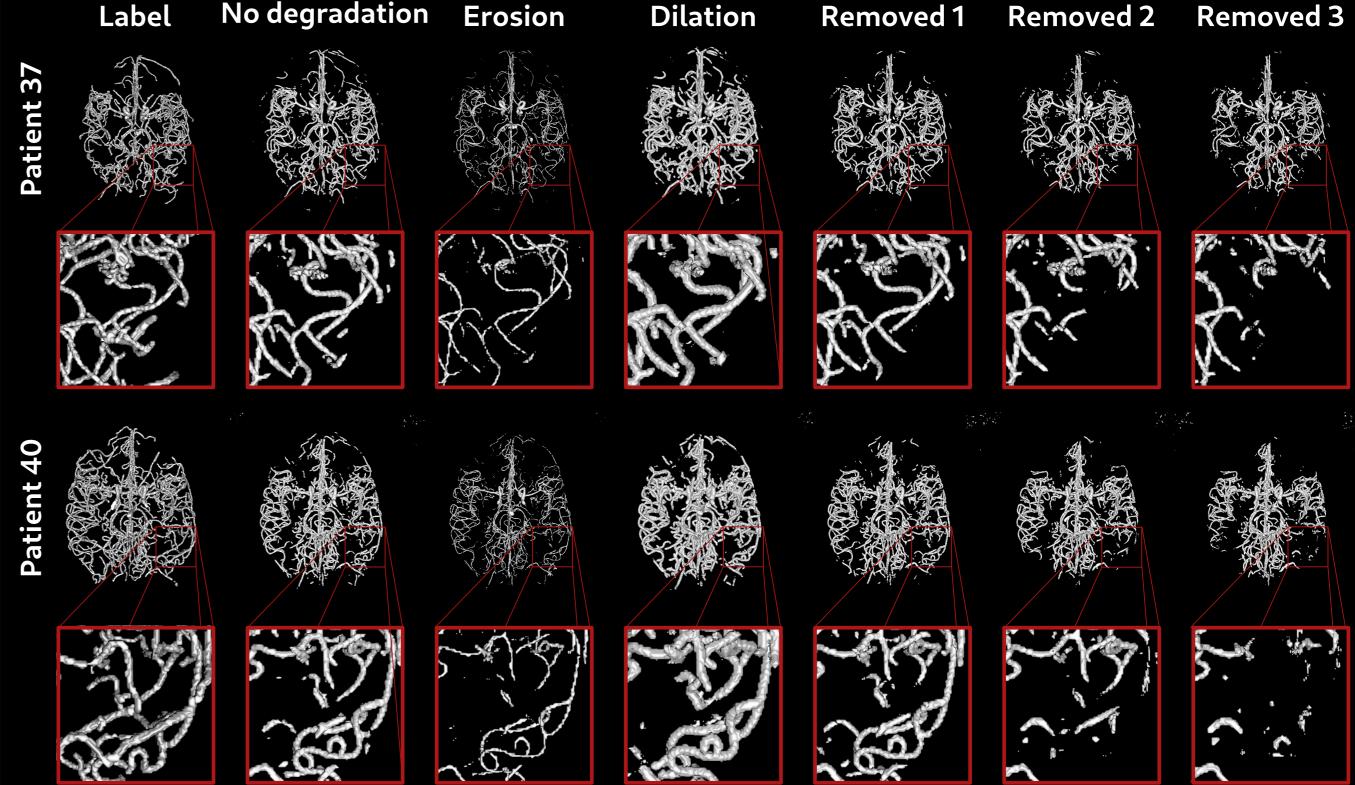
► In this experiment, our objective is to study the impact of both type and degree of label imperfection on the segmentation results.

## **Exp. 1:** Methods comparison and impact of the data availability

The goal of this experiment is to conduct a comparative analysis among various semi-supervised learning methods and assess their performance in comparison to a supervised baseline.







- All semi-supervised methods perform similarly.
- Semi-supervised methods outperform supervised method only for very low data setup.
- Semi-supervised methods are more regularized.

- Erosion and dilation generate a systematic error leading to strong results degradation.
- Missing vessels in the annotations deteriorate less the results and can be partially compensated with more data.
- ▶ Missing vessels can also lead to a systematic error.



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