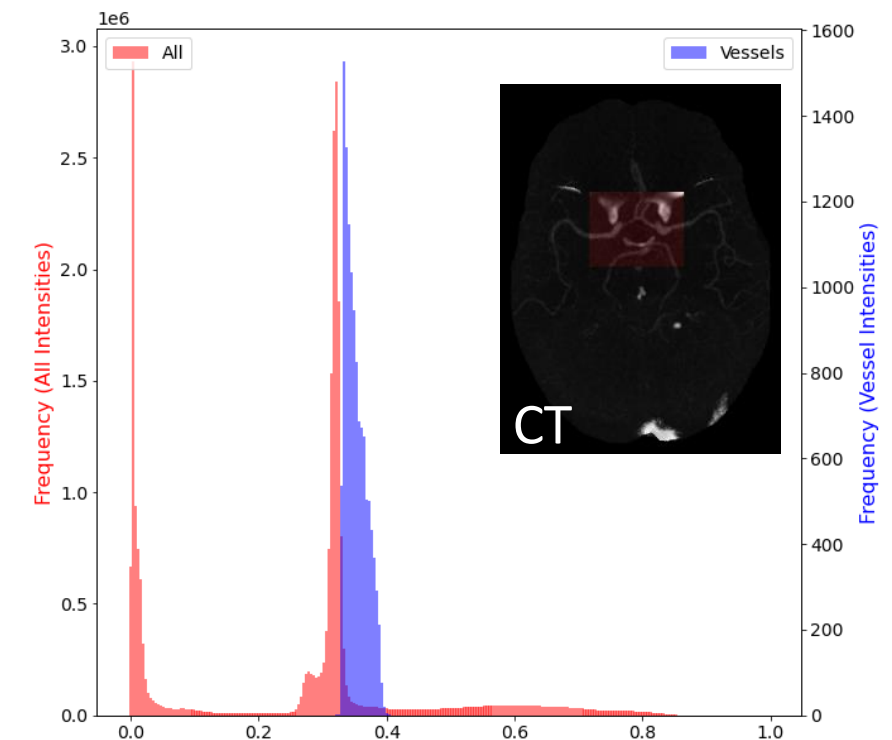
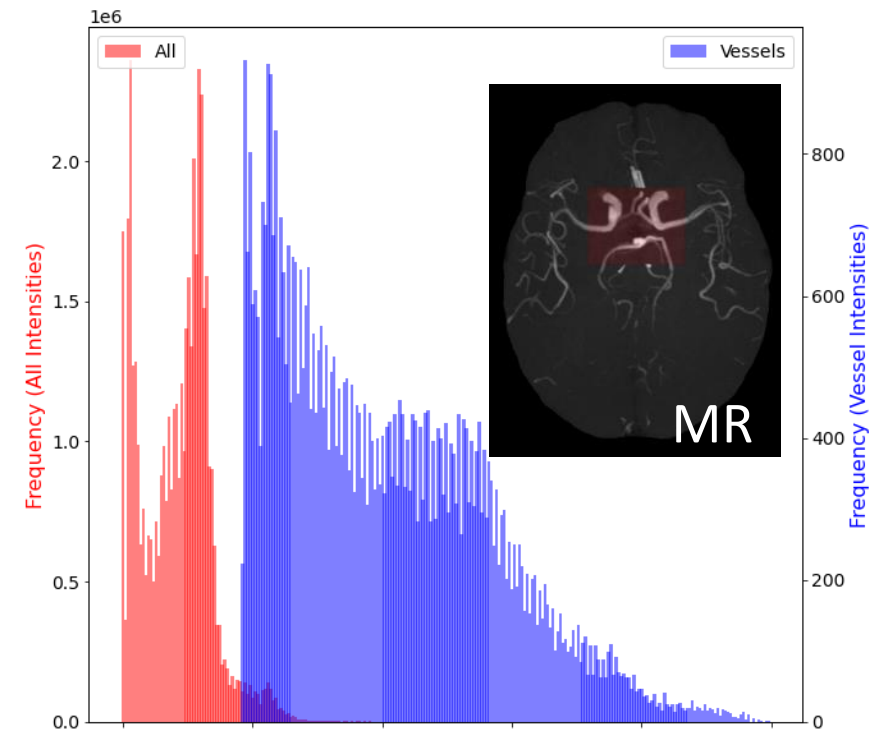


A single model strategy for multi-domain cerebrovascular segmentation

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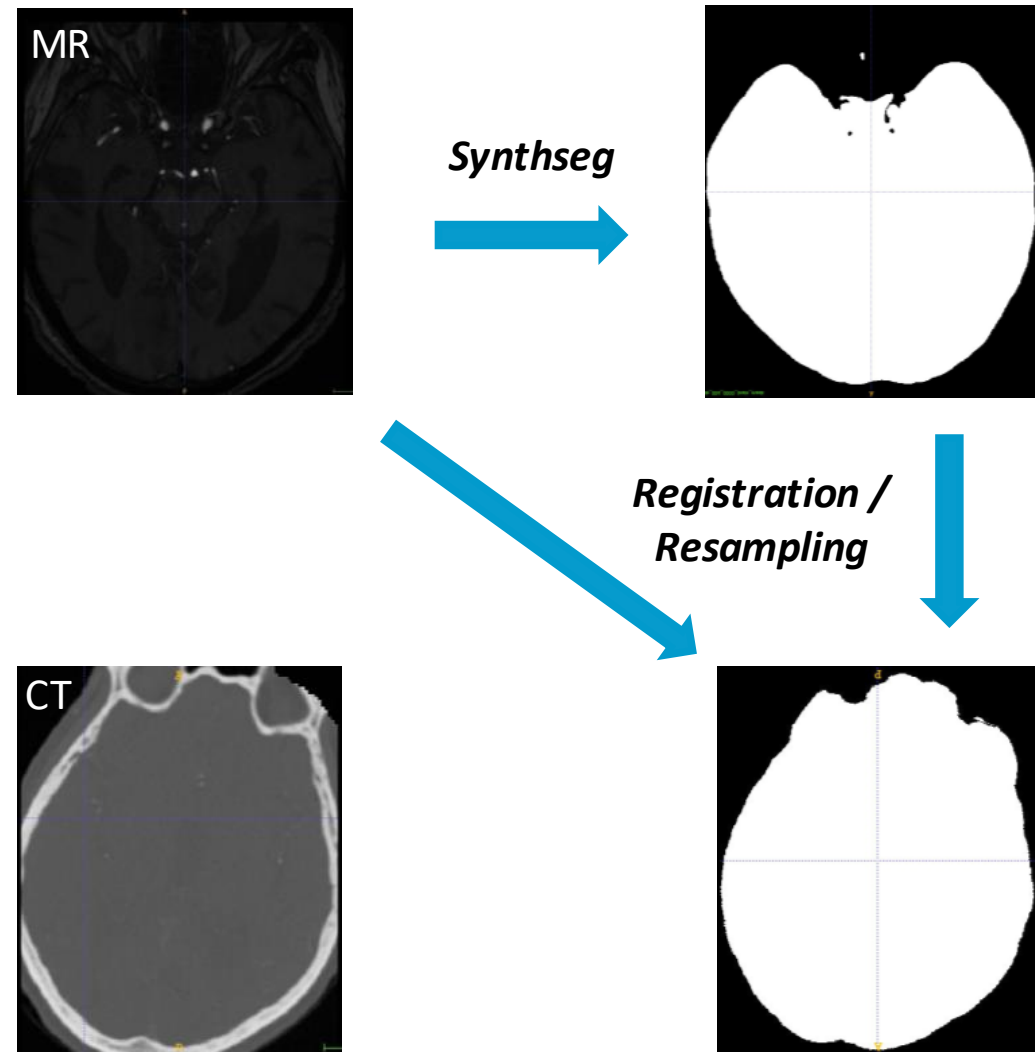
Context

- **Objective of the Challenge:**
- **Circle of Willis (CoW) segmentation** from Computed Tomography (CT) and Magnetic Resonance (MR) 3D joint-modality volumes
- **Our Goals:**
 - Use a single model for both modalities
 - Address the distribution shift ⚠



Training Data – Brain mask generation

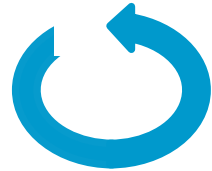
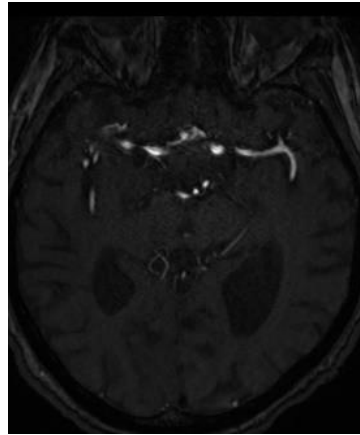
- 90 Patients recovering from various stroke-related neurological disorders
- Brain mask for **MR** volumes generated using Synthseg
- Brain mask for **CT** volumes generated using a process of **registration** and **resampling** starting from the pair-wise MR



B. Billot, et Al. "SynthSeg: Segmentation of brain MRI scans of any contrast and resolution without retraining". Medical Image Analysis (2023)

The method: A2V

Magnetic
Resonance



Computed
Tomography

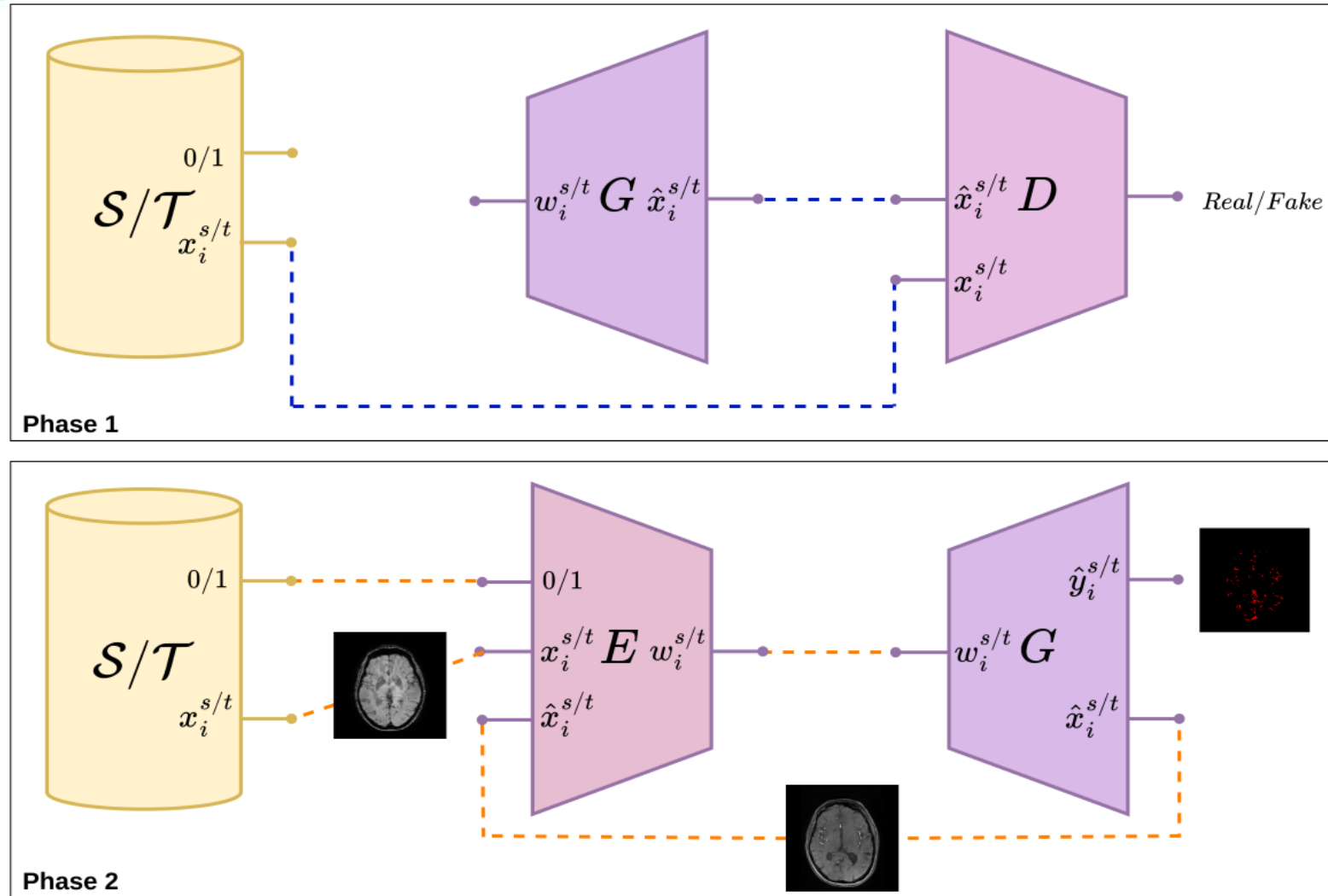


Image-to-
Image
Translation



Segmentation

A2V: Architecture



F. Galati *et al.*, "A2V: A semi-supervised domain adaptation framework for brain vessel segmentation via two-phase training angiography-to-venography translation." (BMVC 2023).

Adapting A2V to TopCow

- **Preprocessing:** ROI-based patch extrapolation
- **Method:** Weighted Loss on ROIs

$$\mathcal{L}_S = \mathcal{L}_{ce}(w \cdot y, w \cdot \hat{y}) + \mathcal{L}_{dice}(w \cdot y, w \cdot \hat{y})$$

- **Postprocessing:** Final output mask binarization

Technical Specifications

Training Setup

- **Optimizer:** Ranger
- **Generator/Discriminator:** Based on StyleGAN2
- **Batch size:** 4
- **Training iterations:** 250k/50k for phase 1-2

Hardware and Libraries

- **Neural Network:** Pytorch 1.9.1
- **GPU:** 2 NVIDIA GeForce RTX 2080 Ti GPUs

Results

Modality	Dataset	Dice	clDice
MR	Local Test	93.88 ± 2.67	95.23 ± 2.20
	Official Test	93.84 ± 2.69	94.42 ± 3.10
CT	Local Test	84.87 ± 4.94	88.67 ± 5.99
	Official Test	84.97 ± 4.39	89.92 ± 5.43

A SINGLE MODEL STRATEGY FOR MULTI-DOMAIN CEREBROVASCULAR SEGMENTATION



GitHub repository

Thank You

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