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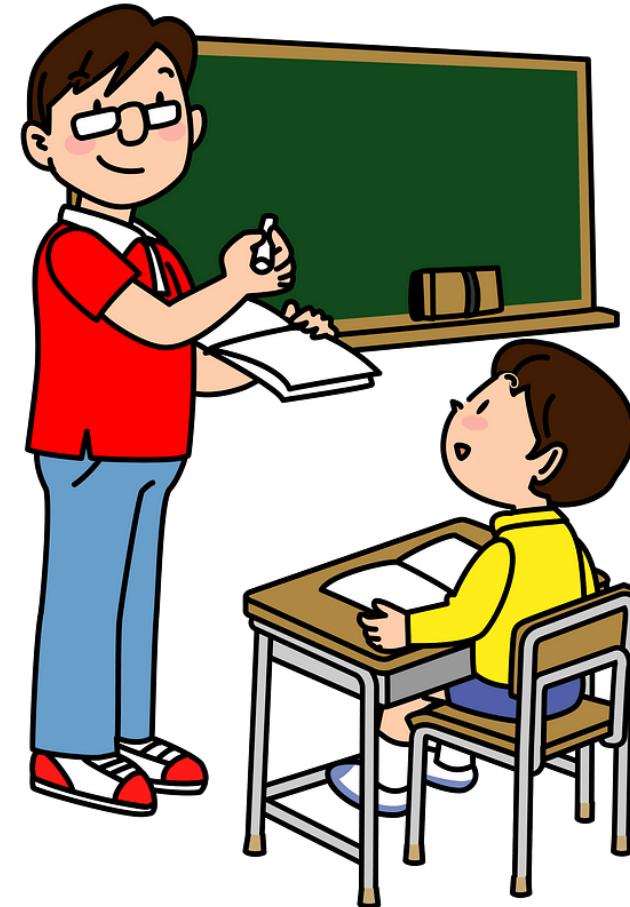
Mila



CIM CENTRE FOR  
INTELLIGENT  
MACHINES

# HAD-Net: A Hierarchical Adversarial Knowledge Distillation Network for Improved Enhanced Tumor Segmentation Without Post-Contrast Images

By: Saverio Vadacchino, Raghav Mehta, Nazanin  
Mohammadi Sepahvand, Brennan Nichyporuk,  
James J. Clark, and Tal Arbel

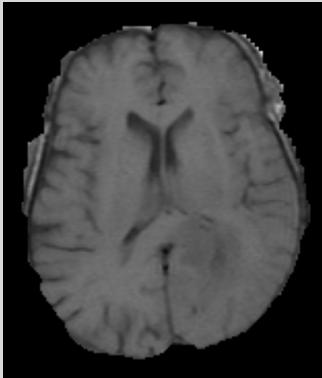


Presented by: Saverio Vadacchino

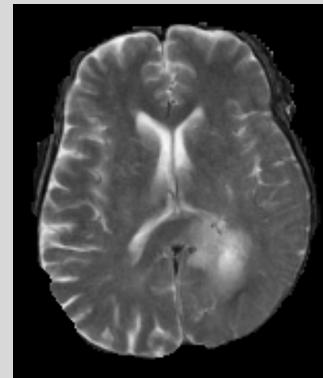
# Introduction

- Different MRI Sequences => Greatly improves tumour or lesion segmentation performance
- T1ce => Crucial for the segmentation of enhancing tumours or lesions

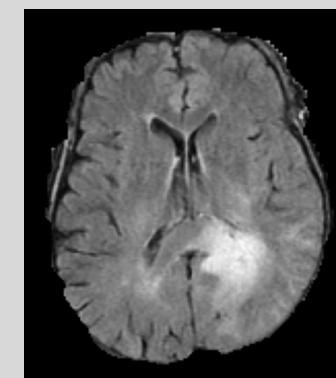
T1



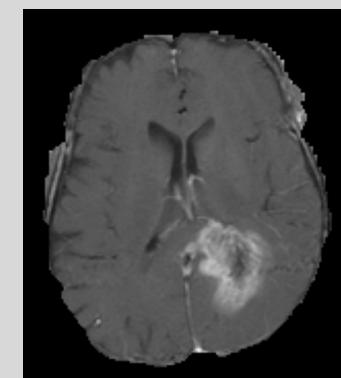
T2



SegAGT

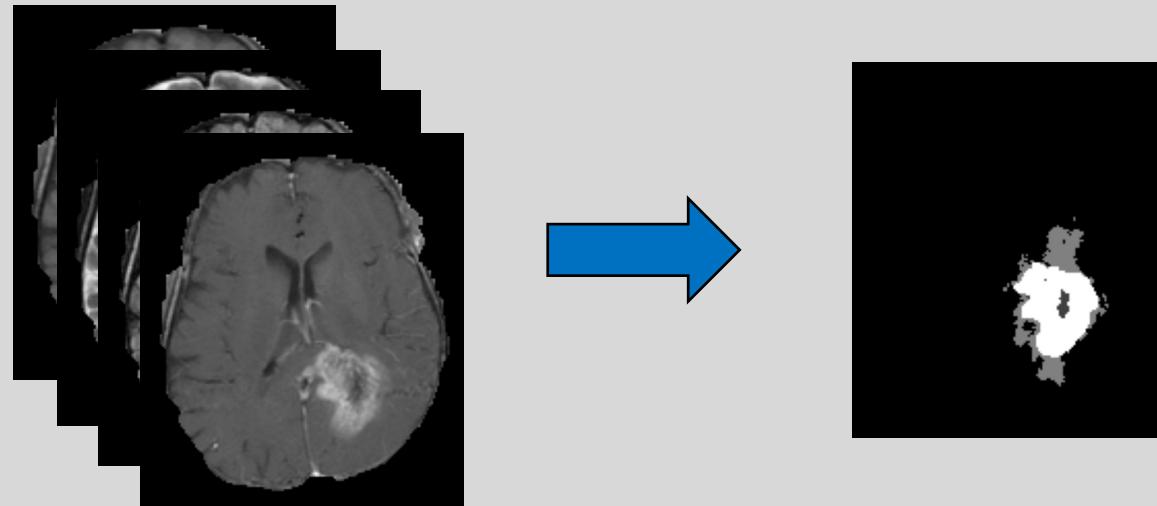


T1ce



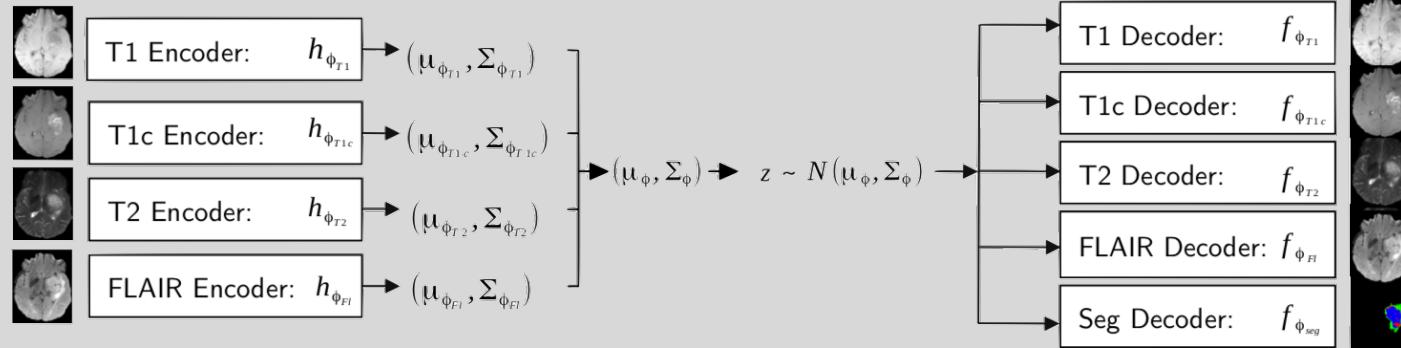
# Introduction

- Contrast agent injection (e.g., Gadolinium)
  - **No longer thought to be safe for patients**
  - **Increases invasiveness**
- Focus on developing a network capable of providing improved enhancing brain tumor segmentations when post-contrast images are unavailable.



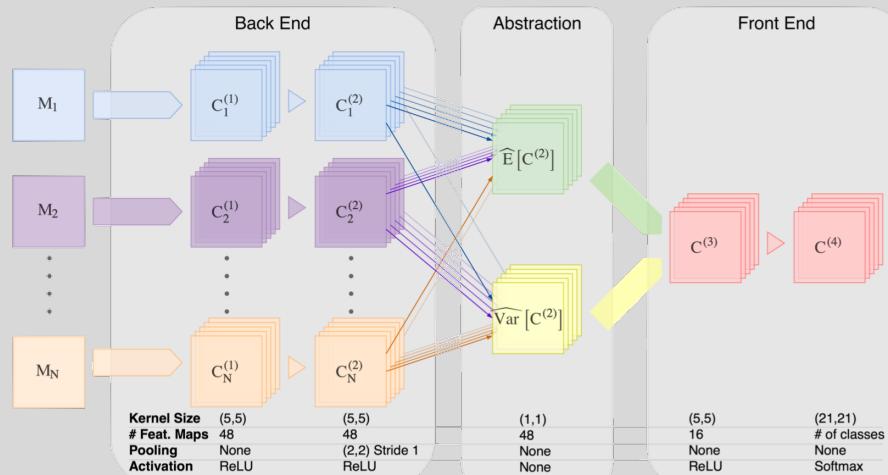
# Related Works

## U-HVED



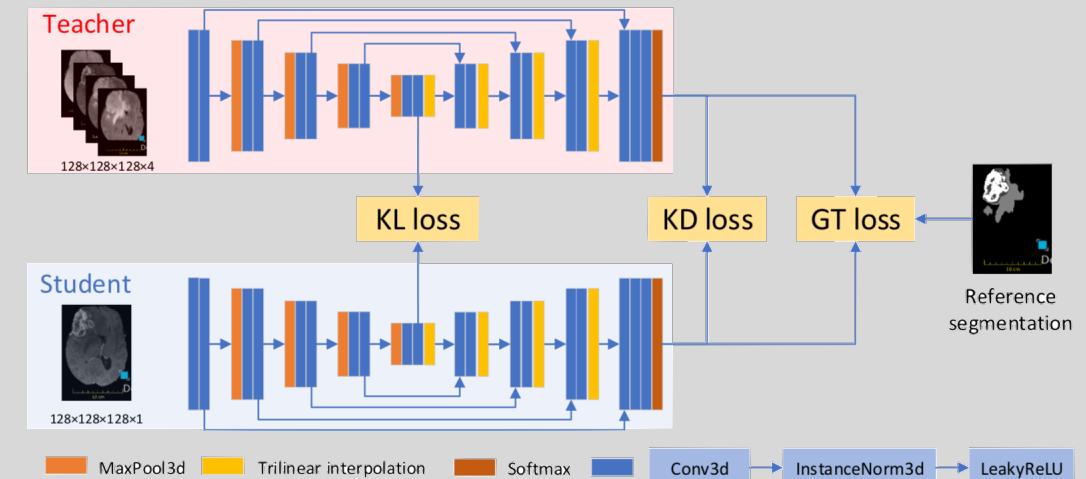
Dorent et al., 2019

## U-HeMIS



Havaci et al., 2016

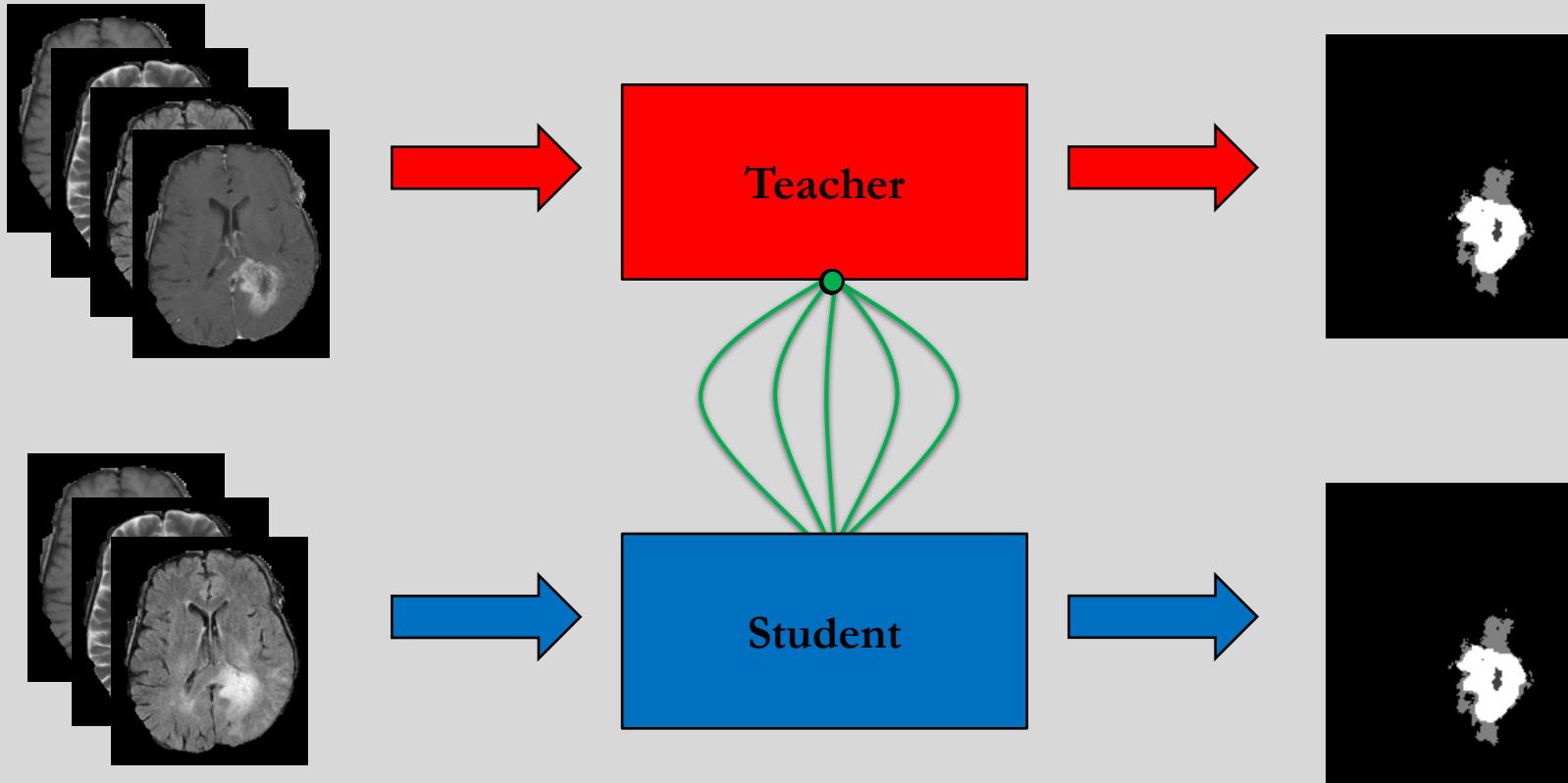
## KD-Net



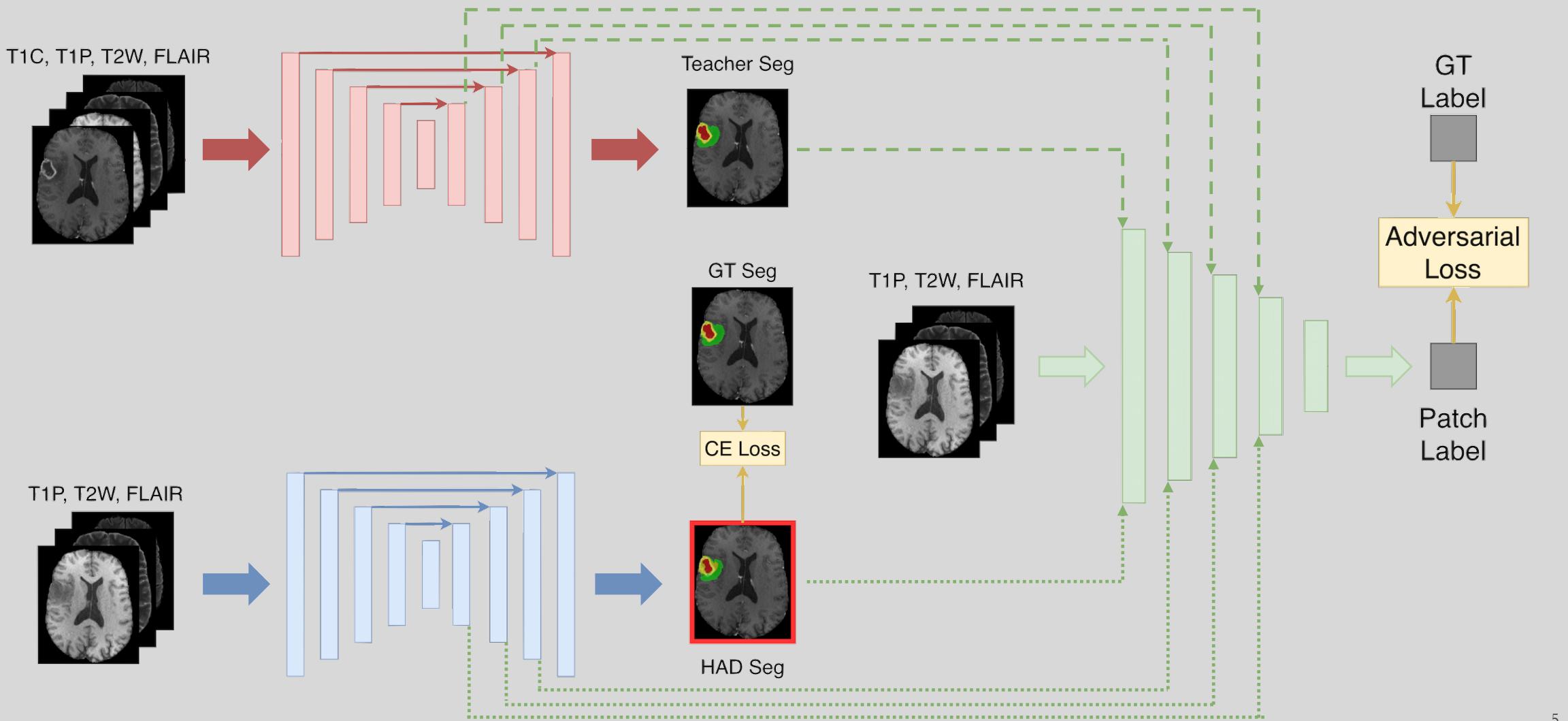
Hu et al., 2020

# HAD-Net

- Teacher network distills knowledge to a student network to produce better segmentations when crucial information is missing.

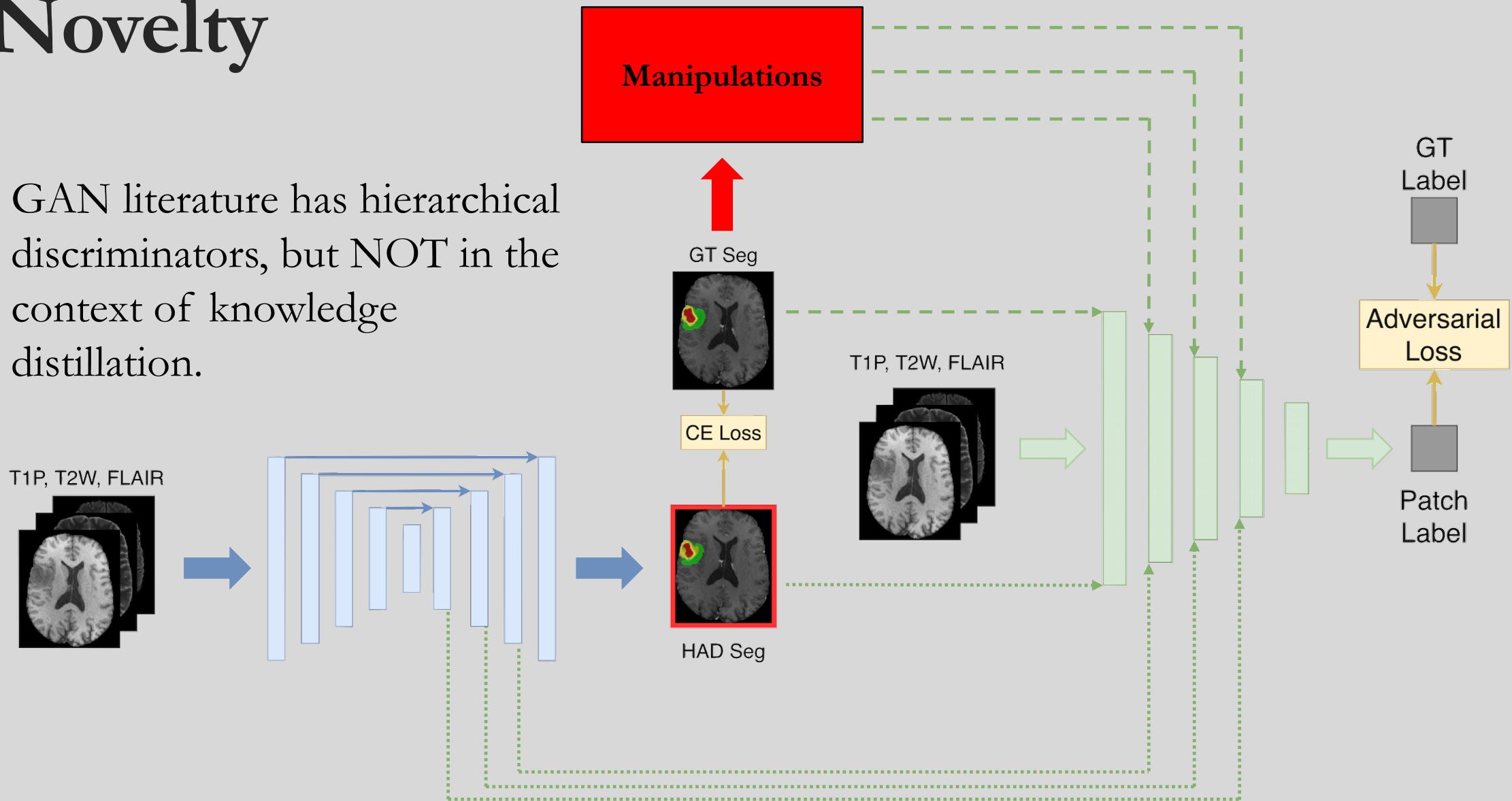


# HAD-Net

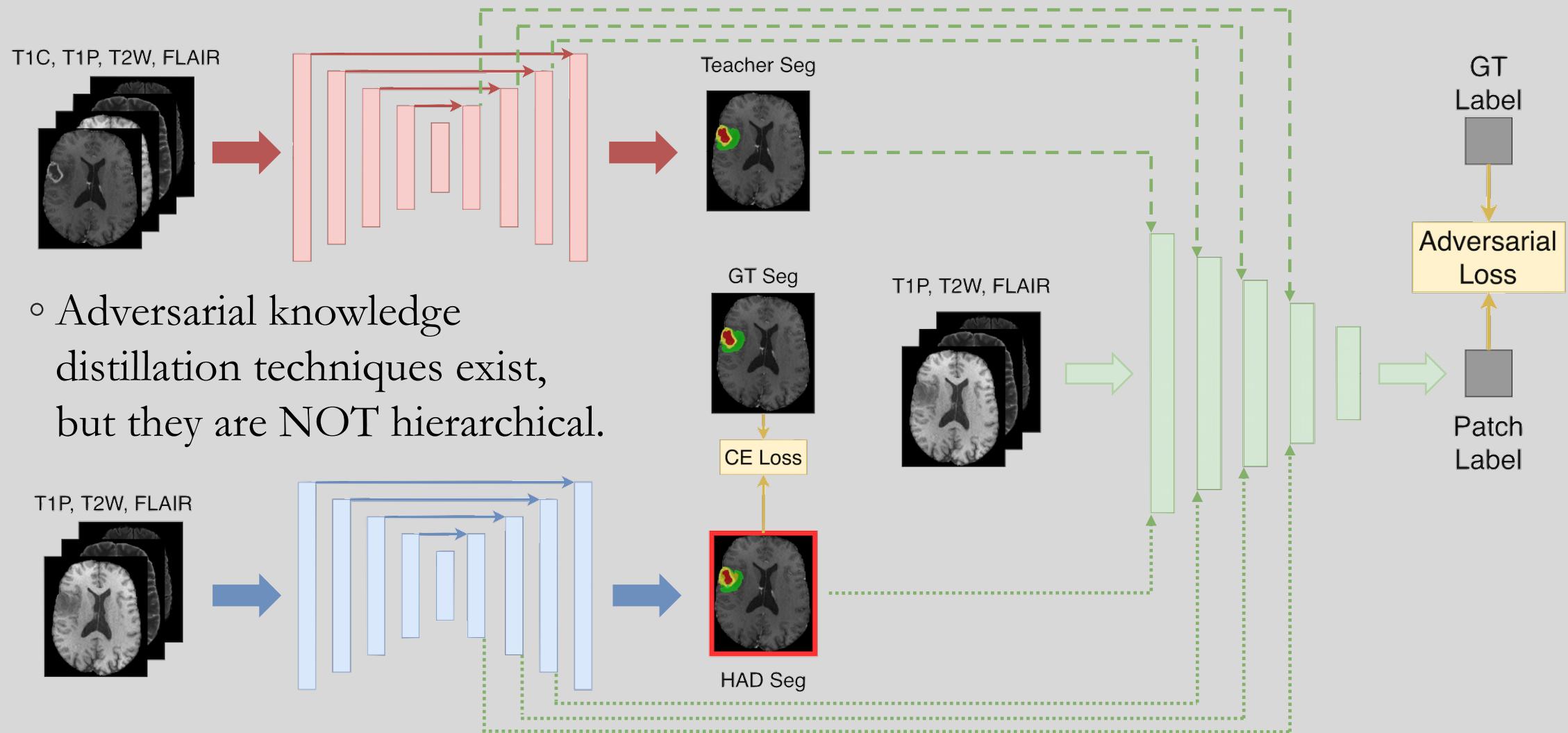


# Novelty

- GAN literature has hierarchical discriminators, but NOT in the context of knowledge distillation.

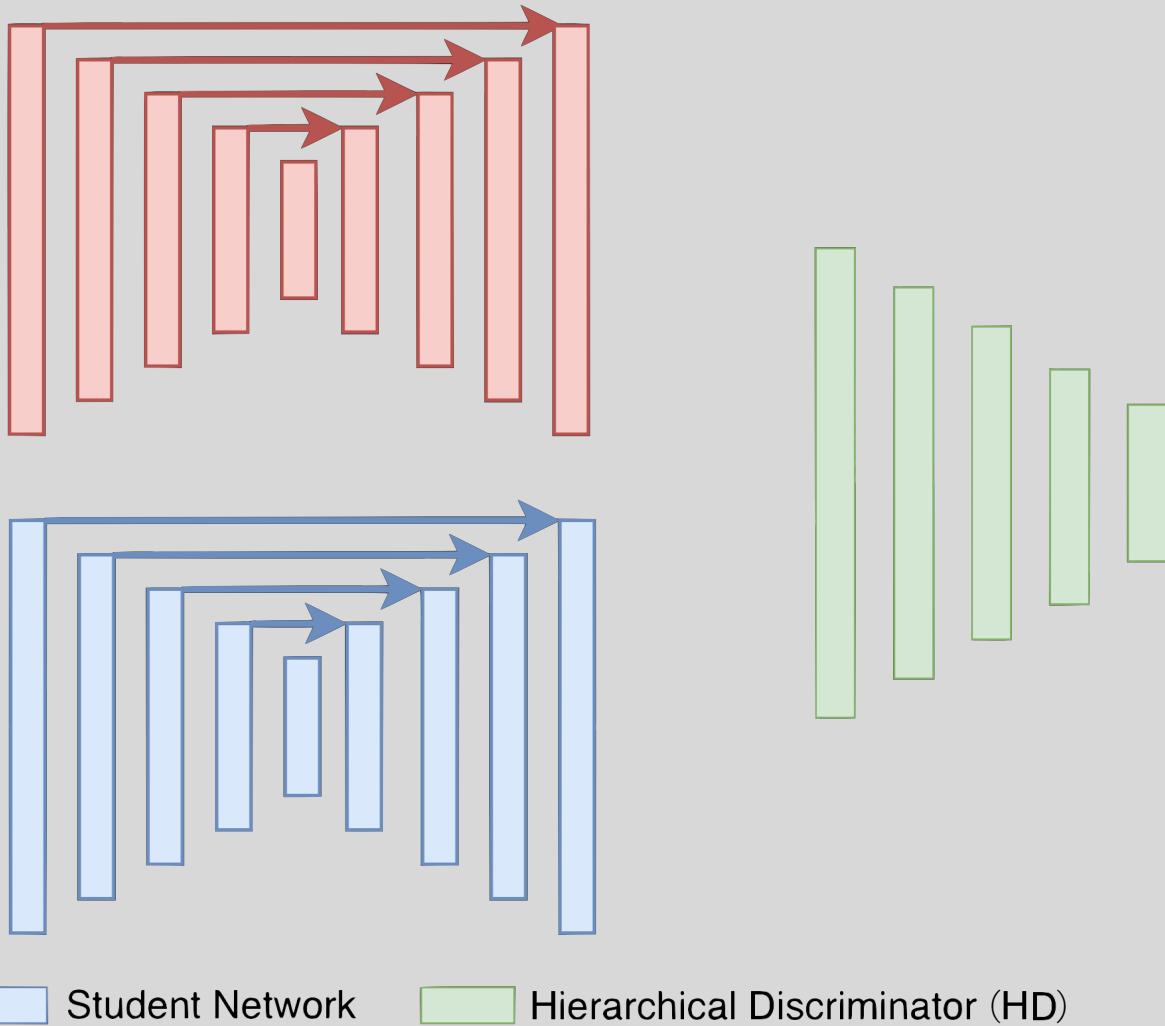


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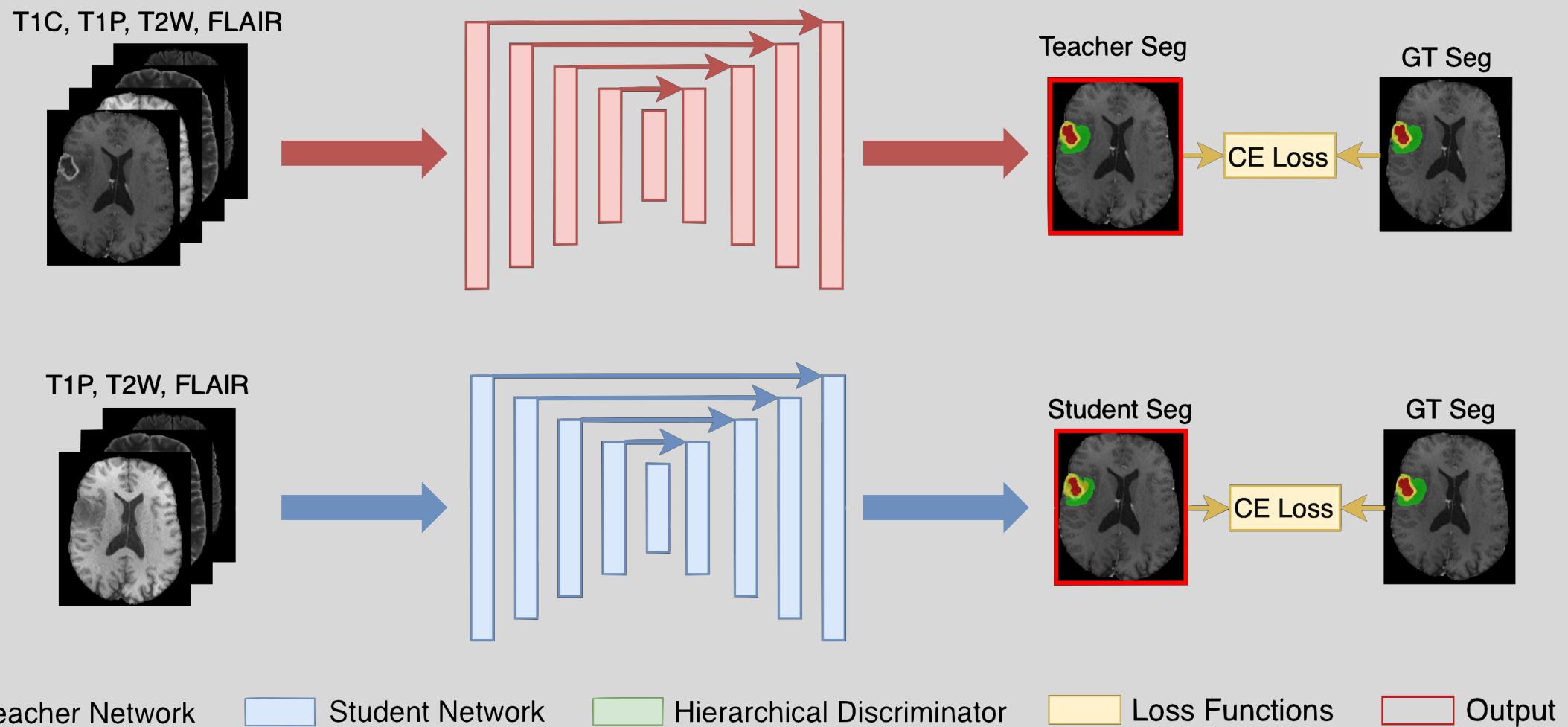


- Adversarial knowledge distillation techniques exist, but they are NOT hierarchical.

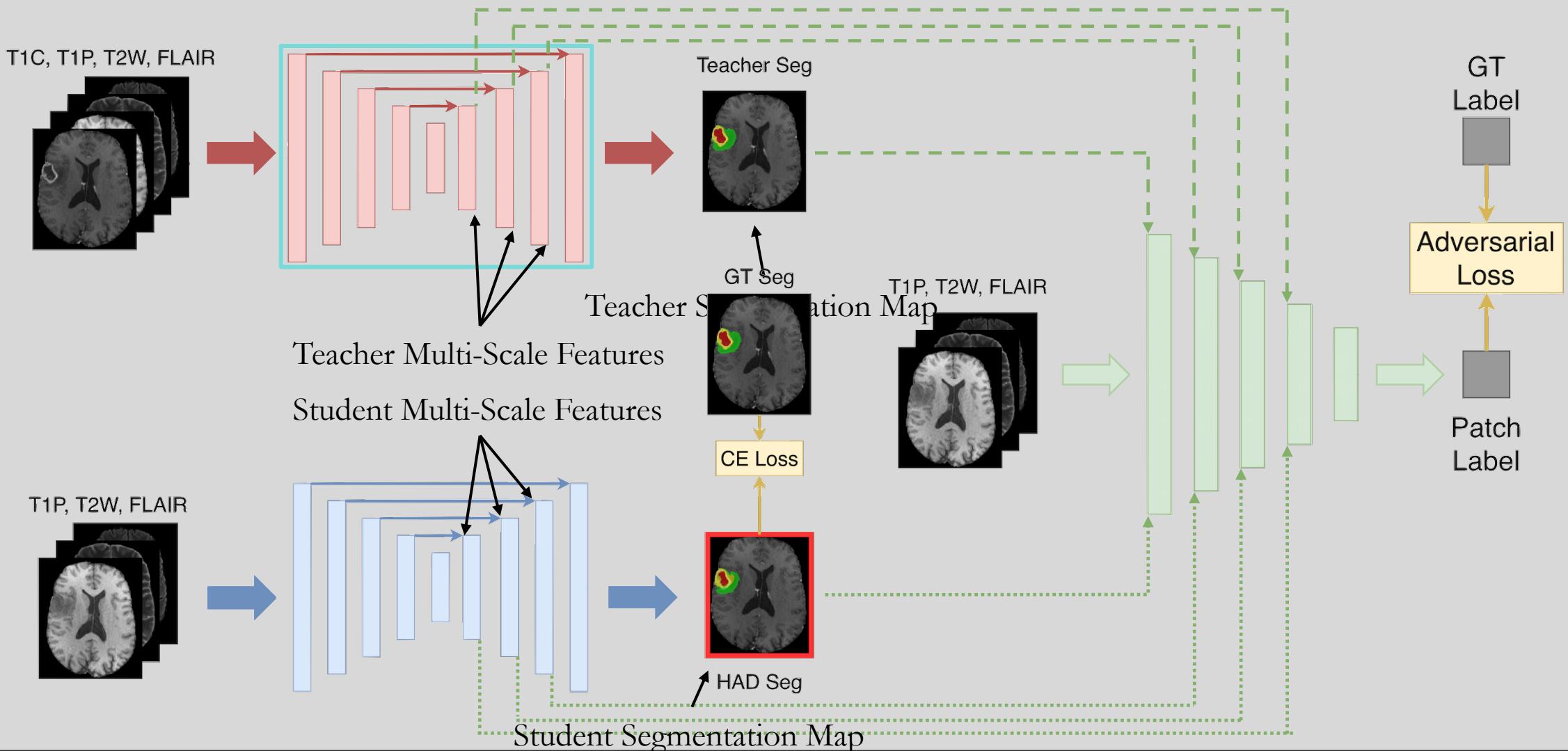
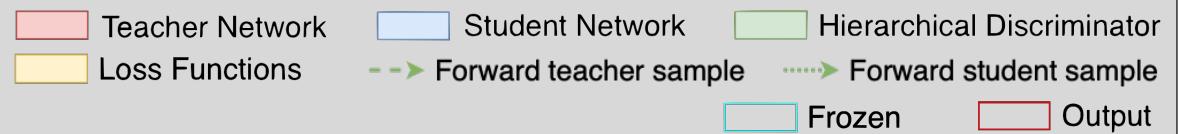
# HAD-Net



# HAD-Net (Pre-) Training



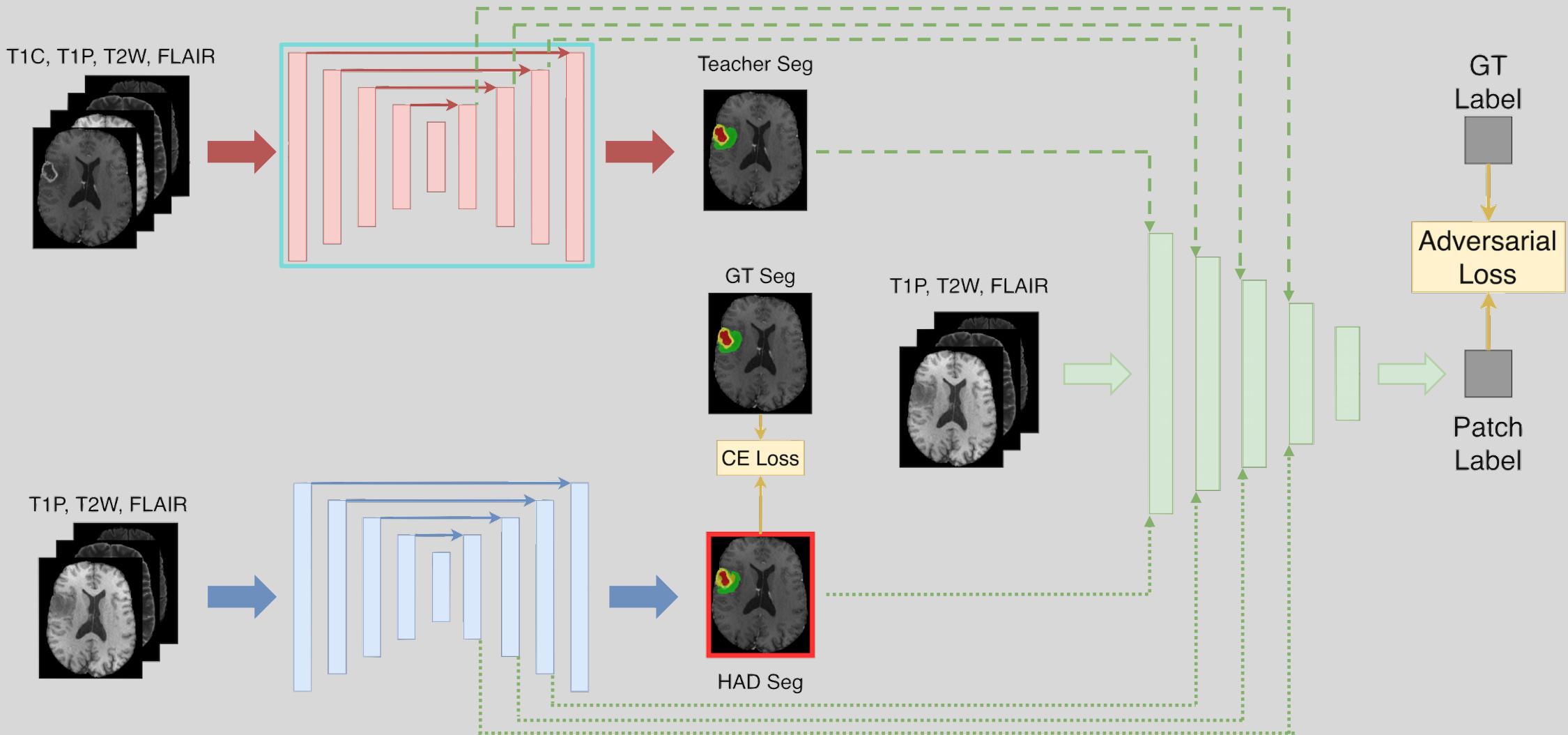
# HAD-Net Training



# HAD-Net Training

Legend:

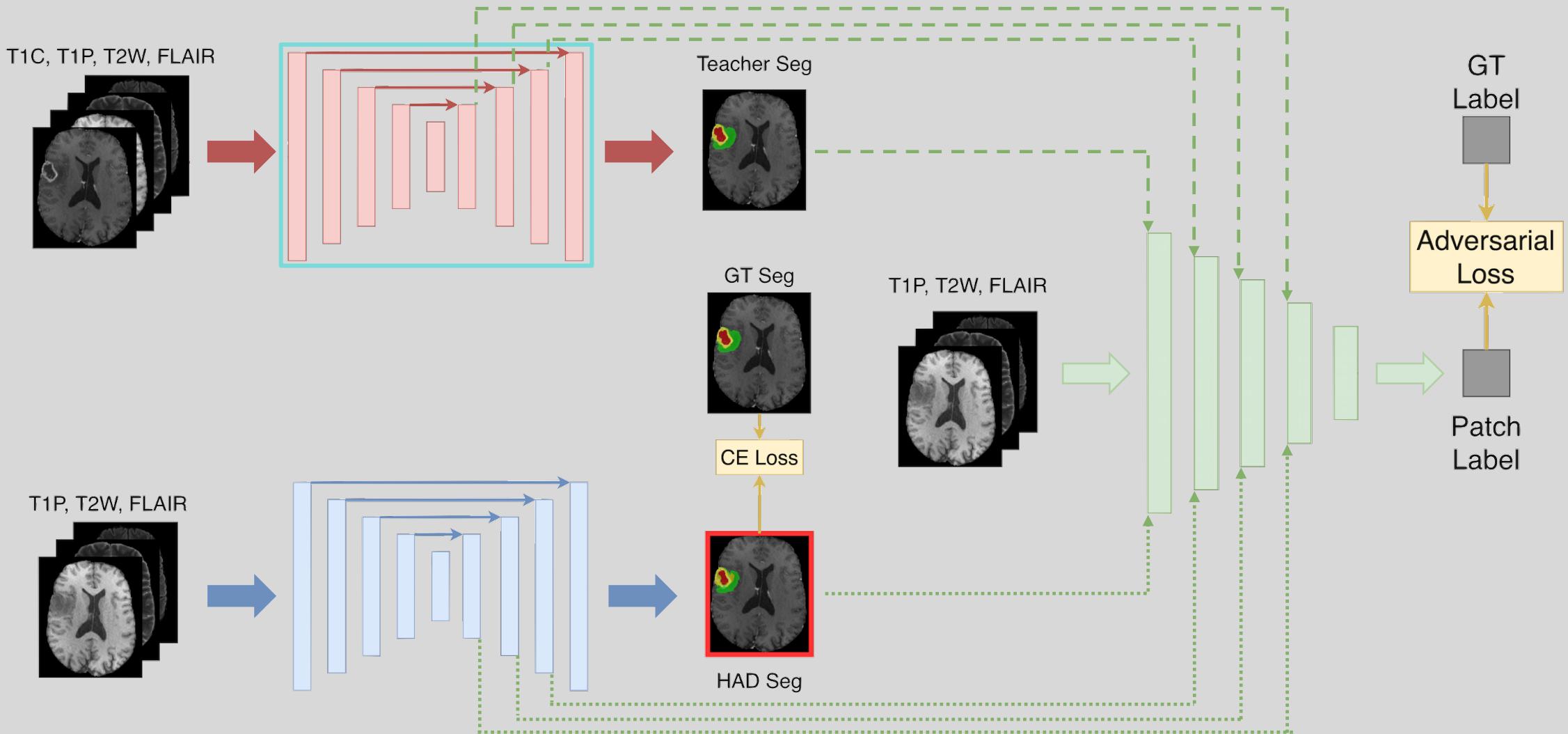
- Teacher Network (Red)
- Student Network (Blue)
- Hierarchical Discriminator (Green)
- Loss Functions (Yellow)
- Forward teacher sample (Dashed Green arrow)
- Forward student sample (Dashed Green arrow)
- Frozen (Cyan Box)
- Output (Red Box)



# HAD-Net Training

Legend:

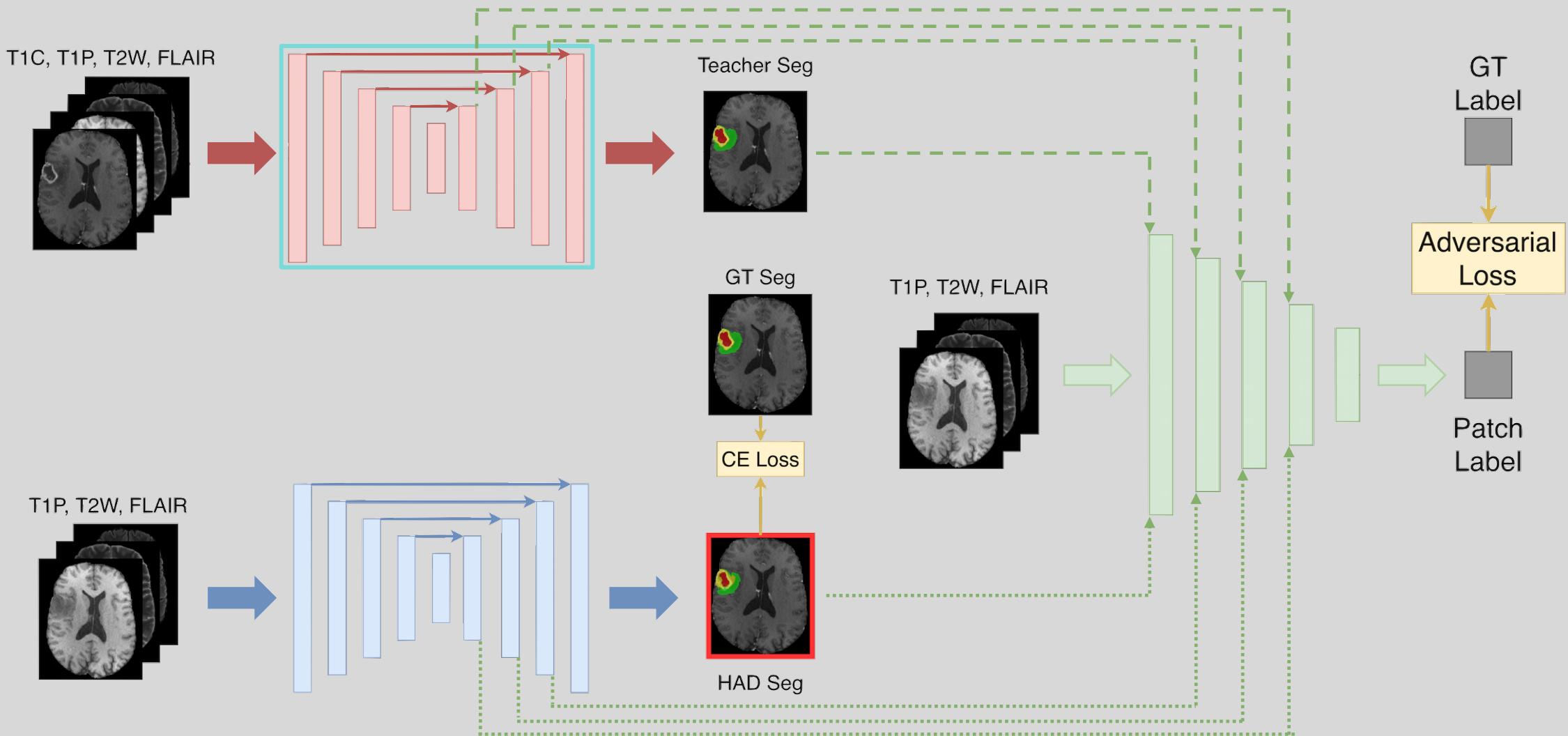
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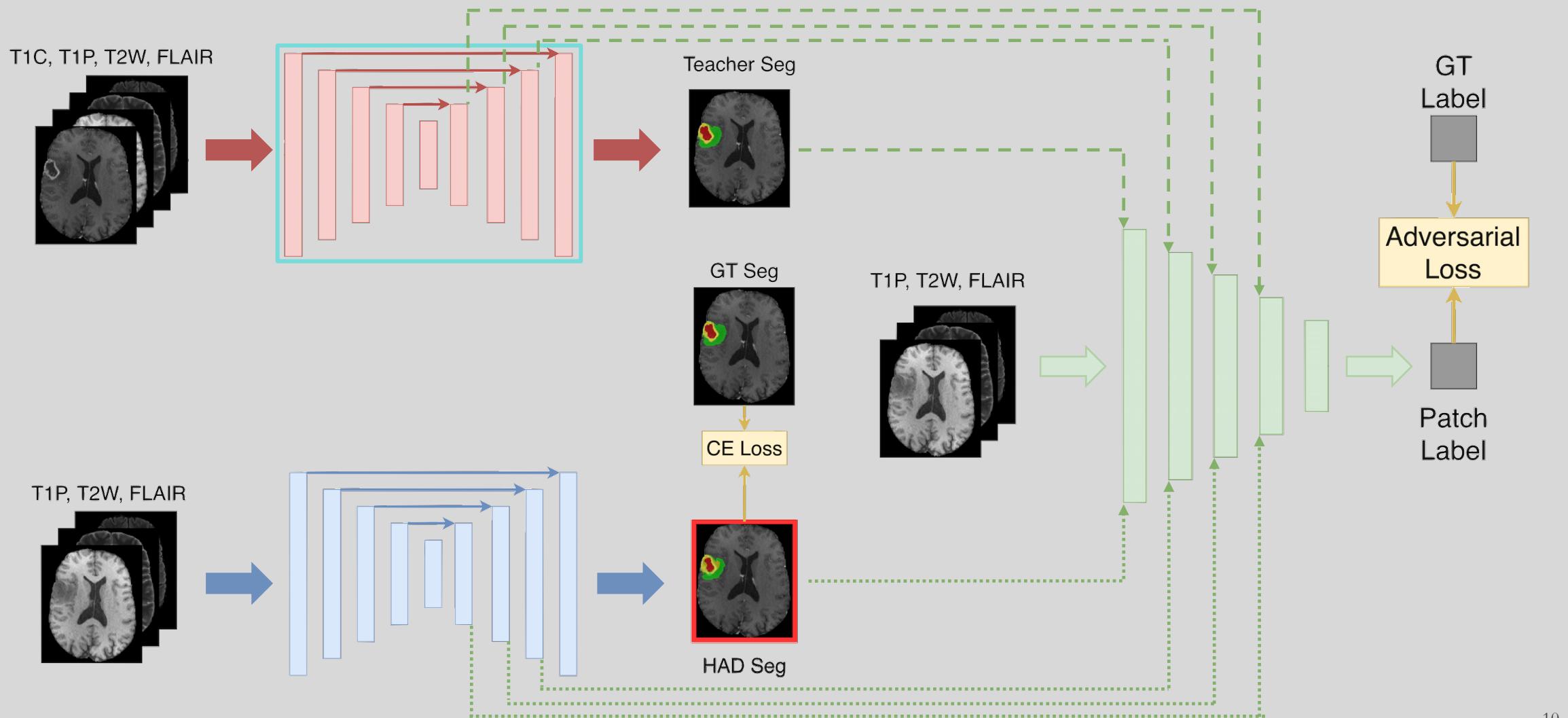
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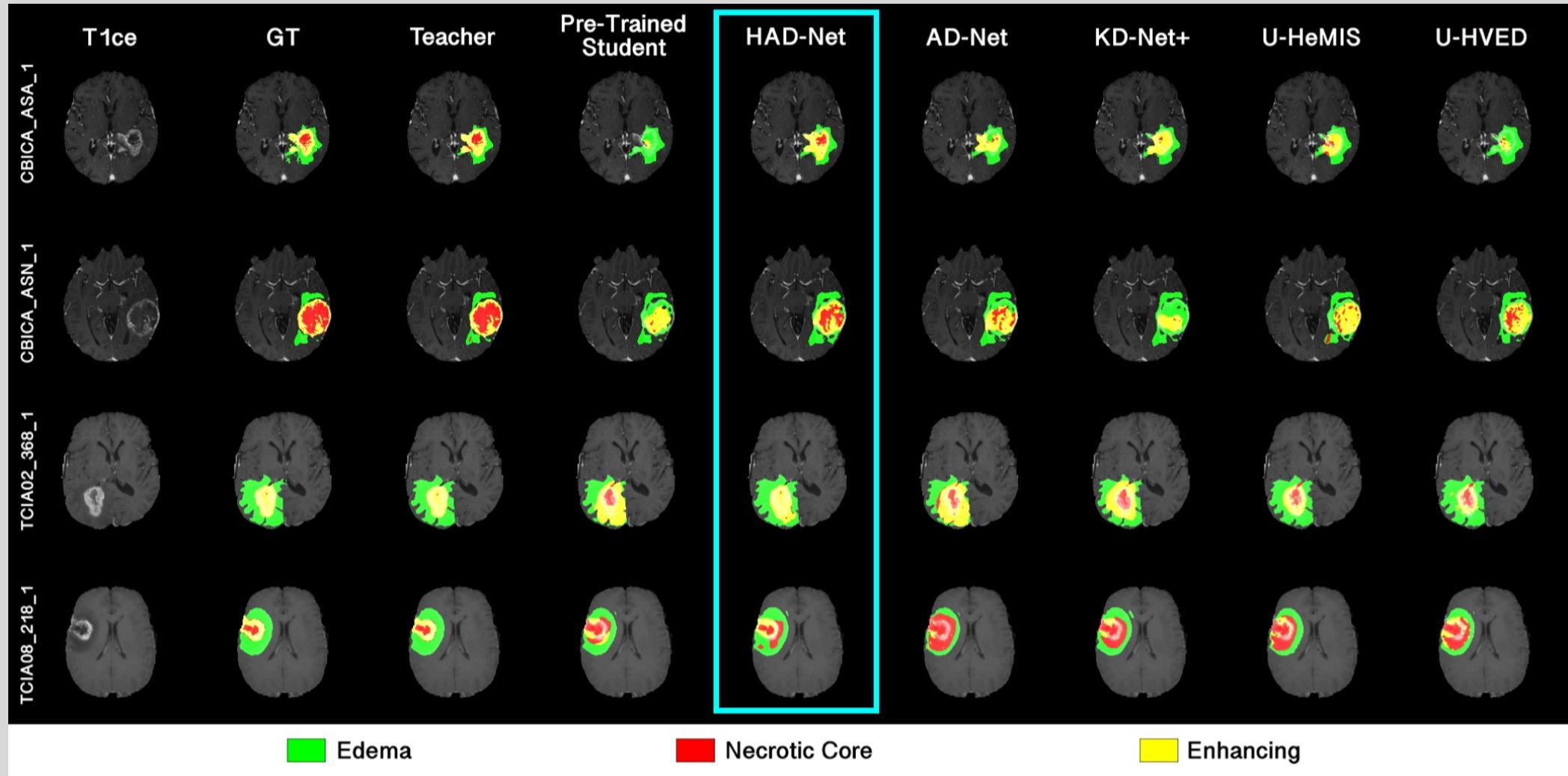
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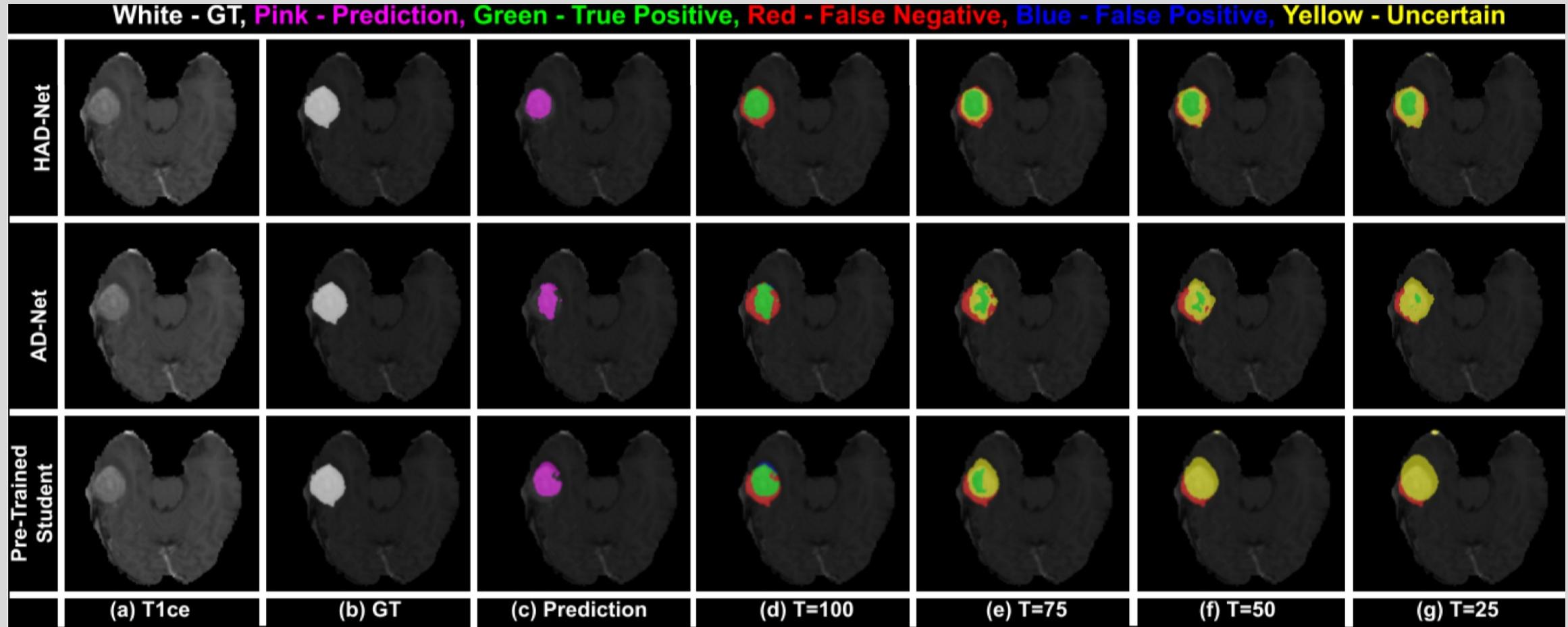
# HAD-Net Inference



# Results



# Results



Thank you and please join us for our  
poster session (poster I8)!



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