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From Infusion to Assimilation Distillation for Medical Image Segmentation

Jiankang Hong[1], Ye Luo[1]*, Yinan Liu[1], Junsong Yuan[2]

[1] Tongji University, China [2] University at Buffalo, USA *Corresponding author

01 ABSTRACT

Foundation models achieve strong segmentation but are costly to deploy. IAD transfers SAM knowledge to student via **knowledge infusion** and **assimilation**, improving Dice by **4.32**, **1.85**, and **2.42** points on Synapse, ACDC, and Polyp, and by **4.16** points on transfer datasets.

Research question

How can student absorb teacher knowledge while preserving its useful semantic capabilities?

02 METHOD

KIS: Distillation and prototype alignment transfer semantics and reduce imbalance.
KAS: Contrastive optimization and reverse constraints improve prediction consistency.

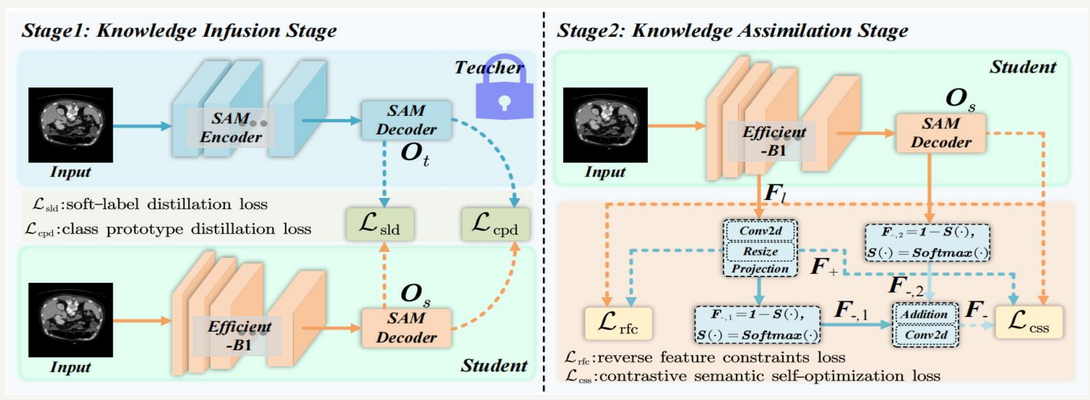


Figure 1. IAD transfers semantics, mitigates imbalance, and adaptively assimilates knowledge.

Implementation details

Synapse, ACDC and binary datasets; PyTorch training; DICE, HD95 and mIoU evaluation with KD comparisons.

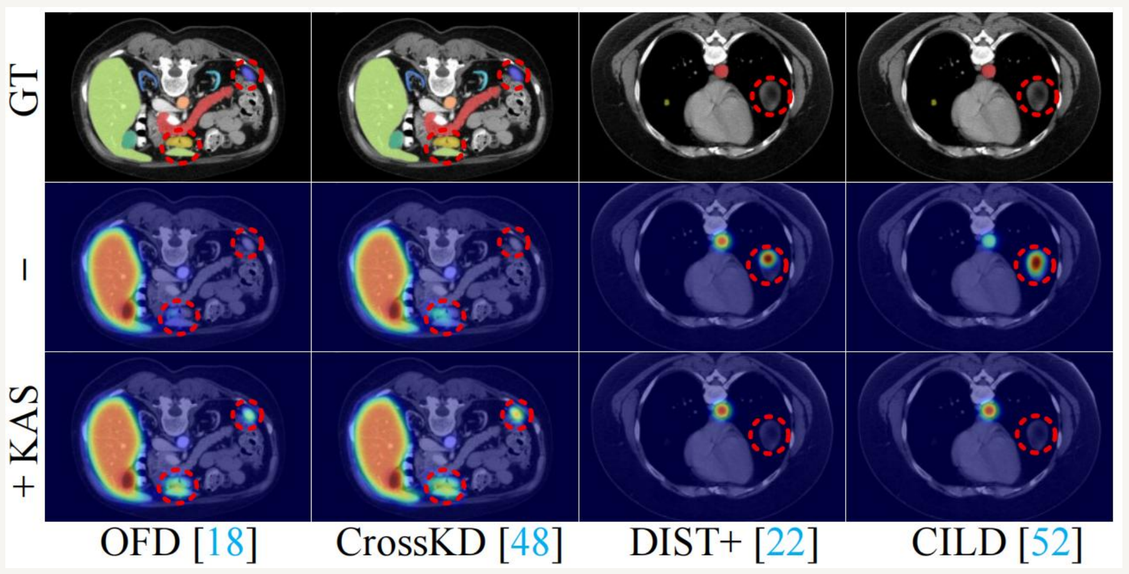
03 RESULTS

Multi-organ Synapse, ACDC, and Binary Polyp datasets segmentation. Metrics: Dice (%), HD95 (mm) and mIoU (%).

Table 1. Comparison with the strongest competing KD Dice.

Method	Synapse	ACDC	Polyp	Transfer
Student	79.85	87.44	75.56	72.40
Best KD	81.75	88.53	77.17	75.60
IAD	**84.17**	**89.29**	**77.98**	**76.56**

Figure 2. Visual results of KD ways before and after KAS.



Key result

KAS corrects mis-segmented and missing regions, promoting knowledge internalization and integration. **Transfer assessment** further shows robust generalization, improving Dice from 72.40% to 76.56% across transfer datasets.

04 DISCUSSION

Future work explores **end-to-end** IAD, broader tasks, stronger generalization, and more efficient knowledge assimilation strategies.

05 CONCLUSIONS

IAD preserves teacher–student strengths and generalizes well; **plug-and-play** KAS further boosts existing KD methods.

CONTACT / CODE

Jiankang Hong | 2510259@tongji.edu.cn
github.com/hjklearn/IAD

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REFERENCES / ACKNOWLEDGEMENTS

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