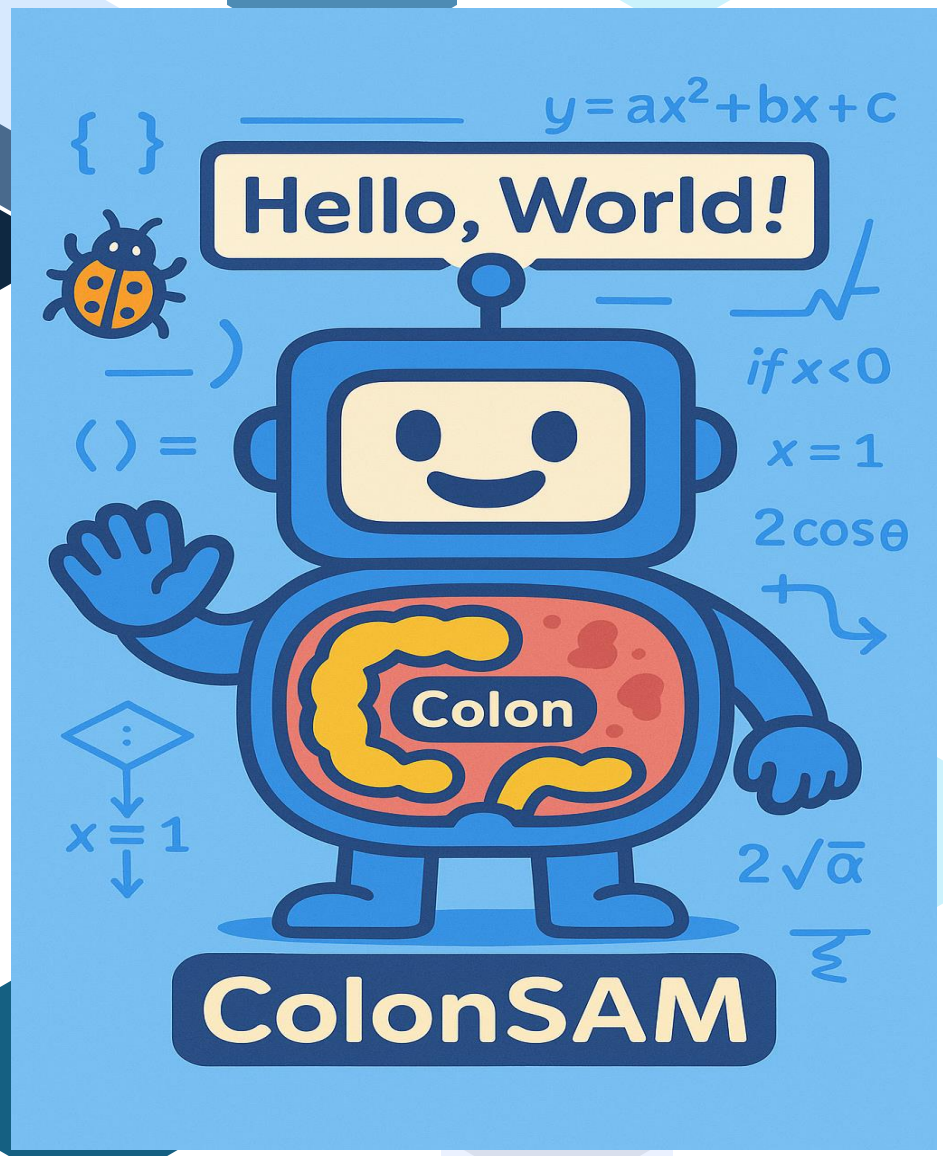
CRCV REU 2025

Week 5

Mentor: Dr. Tian
Student: Syn Nguyen



01. ColonSAM

Goal:

Develop prompt free model to segment polyps

Why:

Colorectal cancer survival rate: 91% (stage I and II), 13% (stage IV)

Contribution:

SOTA, light-weight prompt-free segmentation model

02

Completed



What have been done/ Challenge

- Inference and finetune with tinySAM2
- Read 12 papers on prompt-free SAM
- Found a new dataset:
  - PolypGen
  - 2,225 positive frames
  - 4,275 negative frames



03

Proposed approach



Approach

Konwer, Aishik, et al. Enhancing SAM with Efficient Prompting and Preference Optimization for Semi-Supervised Medical Image Segmentation. Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR), 2025. Computer Vision Foundation. Open Access version.

Direct Preference Optimization

- Generate multiple mask
- Rank them based on IoU score
- Select the highest score and feed back to the model

Challenges

- “First frame prompt”
- Semantic Awareness

04

Results



	Methods	SUN-SEG-Easy (Dice)	SUN-SEG-Hard (Dice)
Seen	2/3D	86.5%	80.9%
	PNS-Net	86.1%	82.3%
	PNS+	88.8%	85.5%
	FLA-Net	87.5%	80.9%
	SLT-Net	90.6%	86.6%
	YOLO-SAM2	94.5%	86.5%
	SAM2-fintuned	**90.3%**	**90%**
Unseen	2/3D	72.2%	70.6%
	PNS-Net	67.6%	67.5%
	PNS+	75.6%	73.7%
	FLA-Net	63.6%	62.8%
	SLT-Net	79.2%	78.1%
	YOLO-SAM2	90%	90.2%
	SAM2-finetuned	**90%**	**89%**

A quantitative comparison of **3D Polypgen dataset** with state-of-the-art methods is presented.

Methods	*mDice*	*mIoU*	*Precision*	*Recall*	*F2*
UNet [3]	0.4559	0.4049	0.5762	0.6307	0.4668
UNet++ [16]	0.4772	0.4272	0.6269	0.6198	0.4876
ResU-Net++ [35]	0.2105	0.1589	0.2447	0.5095	0.2303
MSEG [17]	0.4662	0.4171	0.6120	0.6217	0.4757
ColonSegNet [36]	0.3574	0.3058	0.4804	0.5296	0.3533
UACANet [37]	0.4748	0.4155	0.6108	0.6357	0.4886
UNeXt [38]	0.2998	0.2457	0.3661	0.5658	0.3201
TransNetR [39]	0.5168	0.4717	0.7881	0.5777	0.5105
YOlO-SAM 2	**0.808**	**0.678**	**0.858**	**0.764**	**0.781**

Weekly Plan

Week 1-2

☑ Read papers about SAM2, CLIP-SAM, MedSAM2

☑ Inference with MedSAM2

☑ Inference on SUN-SEG

Week 3-4

☑ Fine-tune SAM2

☑ Read papers about universal prompt free segmentation model

Week 5-8

☐ Find a light-weight prompt-free approach

☐ Create a prompt-free model for colon segmentation

References

Kirillov, Alexander, et al. *Segment Anything*. 2023. arXiv, https://arxiv.org/abs/2304.02643.

Ravi, Nikhila, et al. *SAM 2: Segment Anything in Images and Videos*. 2024. arXiv, https://arxiv.org/abs/2408.00714.

Ma, Jun, et al. "Segment Anything in Medical Images." *Nature Communications*, vol. 15, no. 1, Jan. 2024, https://doi.org/10.1038/s41467-024-44824-z.

Zhu, Jiayuan, et al. *Medical SAM 2: Segment Medical Images as Video via Segment Anything Model 2*. 2024. arXiv, https://arxiv.org/abs/2408.00874.

Wang, Haoxiang, et al. *SAM-CLIP: Merging Vision Foundation Models towards Semantic and Spatial Understanding*. 2024. arXiv, https://arxiv.org/abs/2310.15308.

Ji, Ge-Peng, et al. "Video Polyp Segmentation: A Deep Learning Perspective." *Machine Intelligence Research*, vol. 19, no. 6, Nov. 2022, pp. 531–549. Springer Science and Business Media LLC, https://doi.org/10.1007/s11633-022-1371-y.

Chen, Zhen, et al. *UN-SAM: Universal Prompt-Free Segmentation for Generalized Nuclei Images*. 2024. arXiv, https://arxiv.org/abs/2402.16663.

THANK YOU!

