

# Arjun Balaji Report

## Tasks Assigned:

Reproduce the MedSAM2 and nnUnet model on two datasets.

1. ACDC dataset: <https://www.creatis.insa-lyon.fr/Challenge/acdc/databases.html>
2. CAMUS dataset: <https://www.creatis.insa-lyon.fr/Challenge/camus/index.html>

## Tasks Completed:

1. Implemented MedSAM 2 on ACDC and BCTV
2. Built a custom data preprocessing pipeline to make ACDC compatible with the data pipeline of Med SAM2
  - a. The original ACDC Dataset has nii files, and the Med SAM 2 3D pipeline needs jpg and npy files for the images and the masks respectively, so I had to implement that and arrange it into the folder structure required
  - b. The ACDC dataset also has ES and ED frames separately, to make it compatible with the MedSAM 2 pipeline, I made them into sequential frames like a video following the intuition of the paper
  - c. So, the images have been made into a series of jpg frames and the mask has been made into a series of npy files
3. Fixed issues with the original MedSAM 2 repository, there seems to be a lot of incompatibility issues. Fixing these issues and getting the code to work took a lot of time.
4. Went through a few more papers related to SAM for 3D medical image segmentation
5. Implemented MedSAM2 for the LV and RV separately

6. Went through the nnUNet papers and code base
7. Implemented nnUNetv2 on ACDC
8. Implemented nnUNetv2 on CAMUS

## Overall Results achieved for MedSAM 2 on ACDC with the modifications:

Total Score	0.171
IoU	0.852
DICE	0.911
Epochs	15

## Ventricle-wise results achieved for MedSAM 2 on ACDC with the modifications:

Total Score	Ventricle	IoU	DICE	Epochs
1.568	LV	0.73	0.815	50
0.4693	RV	0.697	0.785	50

## Overall Results achieved for nnUNet on ACDC

	BTCV n=30	ACDC n=200	LiTS n=131	BraTS n=1251	KiTS n=489	AMOS n=360	VRAM [GB]	RT [h]	Arch.	nnU
nnU-Net (org.) [21]	83.08	91.54	80.09	91.24	86.04	88.64	7.70	9	CNN	Yes
nnU-Net ResEnc M	83.31	91.99	80.75	91.26	86.79	88.77	9.10	12	CNN	Yes
nnU-Net ResEnc L	83.35	91.69	81.60	91.13	88.17	89.41	22.70	35	CNN	Yes
nnU-Net ResEnc XL	83.28	91.48	81.19	91.18	<b>88.67</b>	89.68	36.60	66	CNN	Yes

Results from the nnUNet Paper

## Overall Results achieved for nnUNet on CAMUS:

Part	Overall
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DICE	0.891
Epoch	50

## Challenges Faced:

1. The MedSAM2 Code seems to have a lot of issues, there seems to be some CUDA version incompatibility between SAM2 and MedSAM2, the issue is that the MedSAM2 code base is unnecessarily big, it has the entire SAM2 code base within it. So there is a lot of clashes.
2. The data pipeline is only made for the BCTV dataset (3D) and REFUGE dataset (2D), so there needs to be a lot of adjustments made.
3. nnUNet is computationally intensive, so it takes a long time to train for 3D images.

## Papers:

1. Medical SAM 2: Segment medical images as video via Segment Anything Model 2 (CVPR 2024) <https://doi.org/10.48550/arXiv.2408.00874>
2. Interactive 3D Medical Image Segmentation with SAM 2 (CVPR 2024) <https://doi.org/10.48550/arXiv.2408.02635>
3. Segment anything model for medical image segmentation: Current applications and future directions (Elsevier CBM 2024) <https://doi.org/10.1016/j.compbiomed.2024.108238>
4. Segment anything in medical images (Nature 2024) <https://doi.org/10.1038/s41467-024-44824-z>
5. \*\*A Short Review and Evaluation of SAM2's Performance in 3D CT Image Segmentation. (CVPR 2024) <https://doi.org/10.48550/arXiv.2408.11210>