

# HECKTOR 2025

## HEad and neCK TumOR Lesion Segmentation, Diagnosis and Prognosis Using Multimodal Data Fourth Edition

Awards will be given to the top 3 teams per task

+ 1 x NVIDIA DGX Spark prize from our sponsor



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*Less is More: Efficient PET/CT Segmentation and Multimodal Prediction of  
Recurrence-Free Survival and HPV Status in Head and Neck Cancer*

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Team MEDAI 23/09/2025

# Background

Head and Neck Cancers (HNC):

**5th** leading cancer by incidence

Radiotherapy (RT) – Standard Treatment


locoregional failures – **40%** patients after RT

**PET/CT** – diagnosis, prognosis, treatment planning and ...

Current trend – AI + PET/CT : **limited dataset**



**HECKTOR 2025 Challenge**

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1. **Primary** gross tumor (GTVp) and involved **lymph nodes** (GTVn) **segmentation**      2. Recurrence-Free **Survival** (RFS) **Prediction**      3. **HPV Status** Classification

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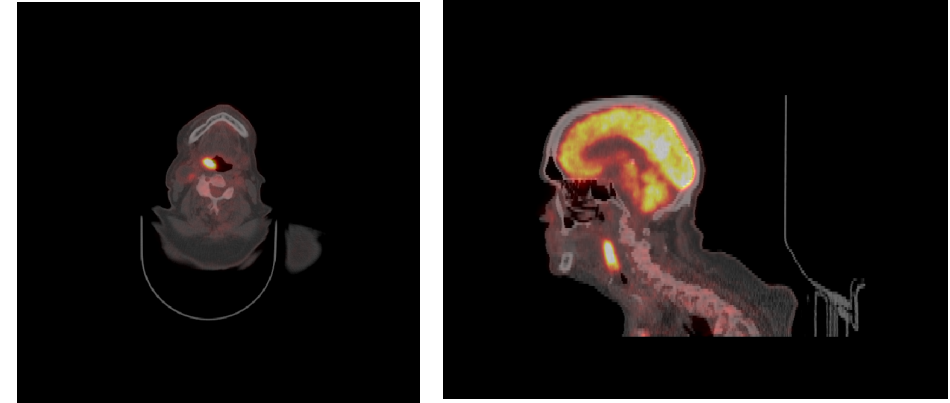


**HECKTOR 2025 Challenge**

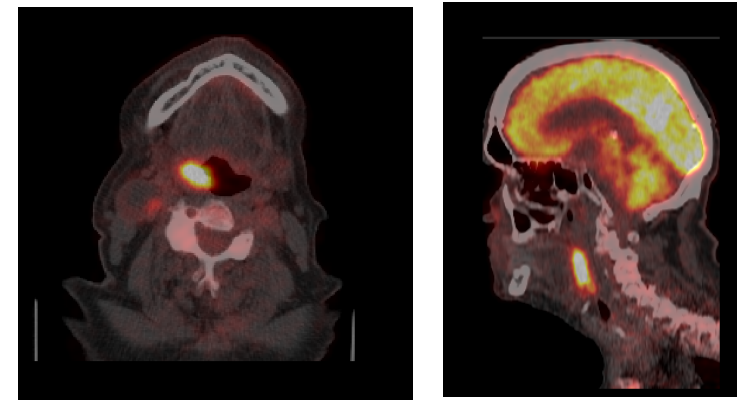
- 
- A horizontal line with a small upward-pointing bracket in the center, spanning the width of the three tasks listed below.
1. **Primary** gross tumor (GTVp) and involved **lymph nodes** (GTVn) **segmentation**
  2. Recurrence-Free **Survival** (RFS) Prediction
  3. **HPV Status** Classification

# Data Preprocessing

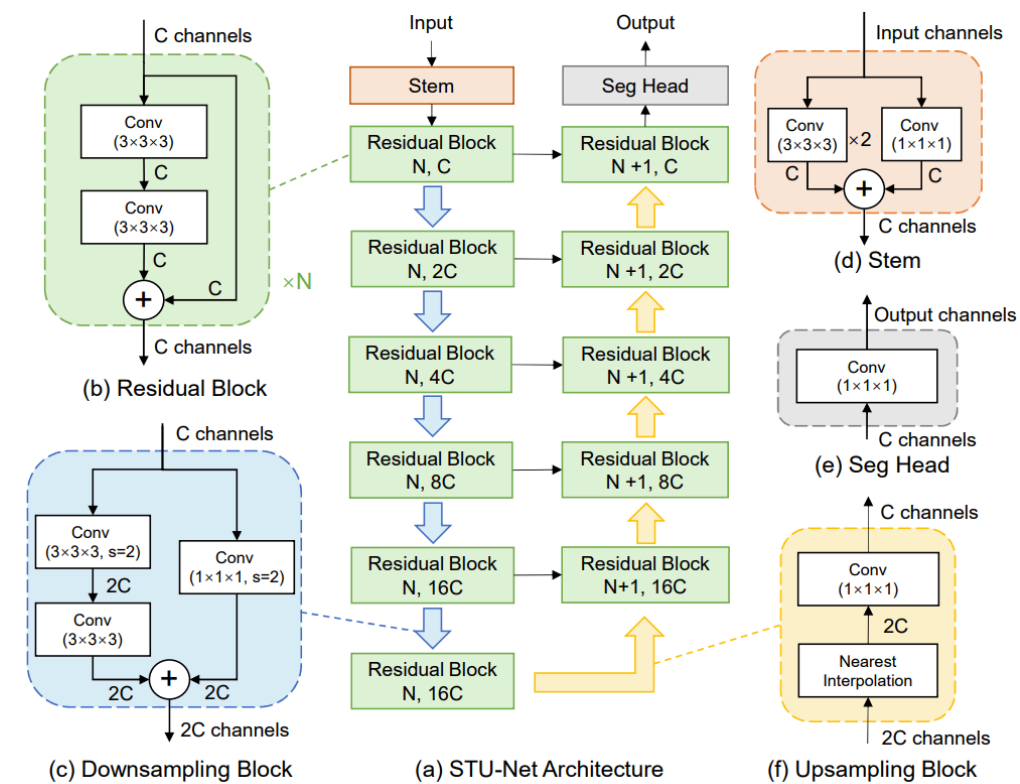
- Resampling to both CT/PET  $1 \times 1 \times 1$  mm
- Detect the top of the head (simple PET thresholding)
- Detect the H&N Centerline
- Crop the bounding box of  $200 \times 200 \times 310$



Preprocessing



# Methods: Task 1 GTVp and GTVn Segmentation



STU-Net

Computational Expenses					
	Param (M)	FLOPs (T)	Training Time (s)	Depth	Width
STU-Net-S	14.55	0.66	41	(1,1,1,1,1,1)	(16,32,64,128,256,256)
STU-Net-B	58.16	2.62	78	(1,1,1,1,1,1)	(32,64,128,256,512,512)

The comparison of computational cost of STU-Net-S and STU-Net-B  
Training time is per epoch

5-Fold cross validation and 10-Fold cross validation using STU-Net-S

5-Fold cross validation using STU-Net-B

nnUNet hyper-parameters configuration was used

NVIDIA RTX A6000

# Results: Task 1 GTVp and GTVn Segmentation

Table 1: Segmentation Performance Using 5-Fold Cross Validation

	Fold 1	Fold 2	Fold 3	Fold 4	Fold 5	Average
Dice (GTVp)	0.7307	0.6761	0.6921	0.6934	0.6790	0.6943
Dice (GTVn)	0.6399	0.6621	0.6862	0.6595	0.6632	0.6622
F1 (GTVn)	0.5942	0.6590	0.6768	0.6581	0.6269	0.6430

Table 2: Segmentation Performance Using 10-Fold Cross Validation

	Fold 1	Fold 2	Fold 3	Fold 4	Fold 5	Fold 6	Fold 7	Fold 8	Fold 9	Fold 10	Average
Dice (GTVp)	0.6891	0.7295	0.6586	0.7384	0.6710	0.6813	0.6551	0.6292	0.7027	0.6777	0.6833
Dice (GTVn)	0.6523	0.6290	0.6713	0.6170	0.5558	0.6528	0.6532	0.6423	0.6617	0.6232	0.6359
F1 (GTVn)	0.6165	0.6085	0.6748	0.5371	0.5573	0.5990	0.6096	0.6466	0.6078	0.5495	0.6007

Segmentation Performance Using 5-Fold Cross Validation (STU-Net-B)

	Fold 1	Fold 2	Fold 3	Fold 4	Fold 5	Average
Dice (GTVp)	0.7254	0.6744	0.6899	0.6974	0.6693	0.6913
Dice (GTVn)	0.6323	0.6885	0.6870	0.6831	0.6464	0.6675
F1 (GTVn)	0.5843	0.6751	0.6789	0.6481	0.6258	0.6424

The experiment setup is the same as 5-fold cross validation using STU-Net-S

# Results: Task 1 GTVp and GTVn Segmentation

Table 3: Leaderboard External Validation (Num≈50) of Segmentation Performance

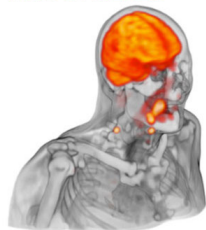
	Ensemble (5-Fold)	Ensemble (10-Fold)
Dice (GTVp)	0.7626	0.7653
Dice (GTVn)	0.7931	0.7932
F1 (GTVn)	0.6385	0.6641

# Conclusion

- STU-Net-S is lightweight yet efficient; larger, more complex models do not necessarily yield better segmentation.
- Ensemble is crucial for achieving strong segmentation performance.



# Acknowledgement



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