

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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HECKTOR 2025

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

Lishan Cai, XingLong Liang, Tianyu Zhang, Jiaju Huang, Tao Tan, and Yunchao Yin

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**



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

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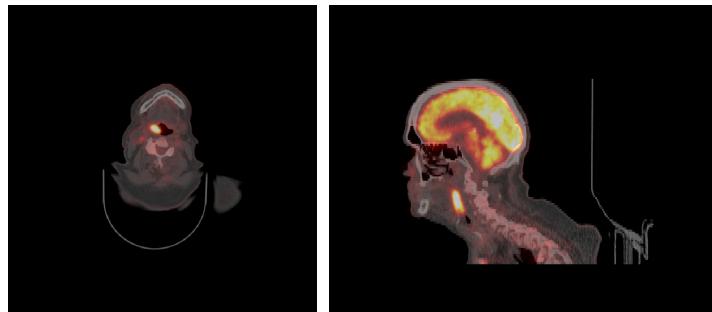


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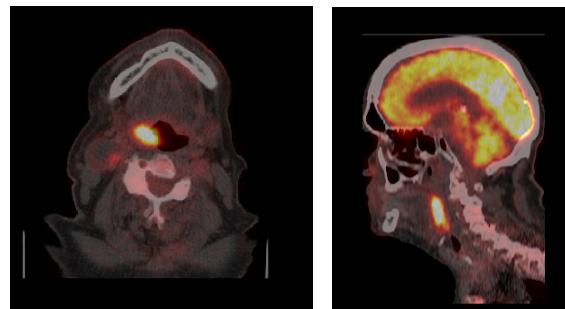
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1. Primary gross tumor (GTVp) and involved lymph nodes (GTVn) segmentation
 2. Recurrence-Free Survival (RFS) Prediction
 3. **HPV Status Classification**

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 × 200 × 310**



↓ Preprocessing



Segmentation
Models Inference
(STU-Net-S)

From Task 1

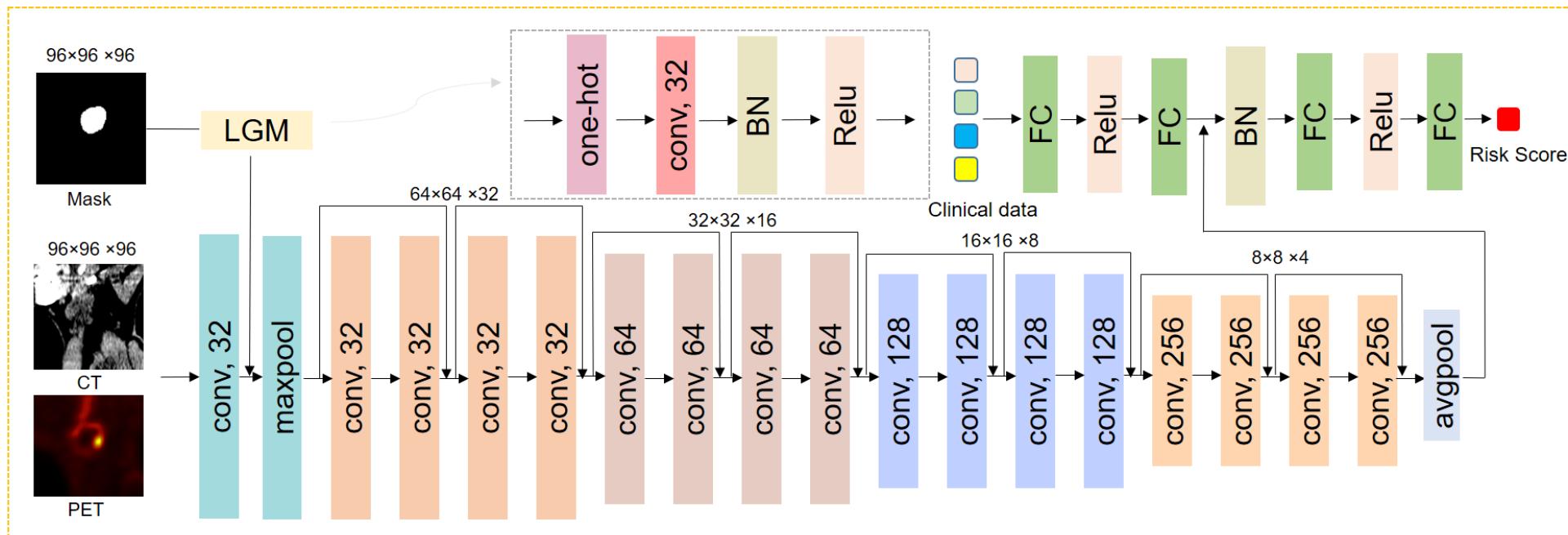


Predicted Masks

Data Preprocessing

- **Clinical variables:** demographics, treatment factors, and imaging biomarkers (MTV, NTV, T-SUV, N-SUV, TLG, NLG).
- **Imaging input:** $96 \times 96 \times 96$ lesion-centered patch with CT (clipped & normalized), PET, and mask (predicted channels (background, tumor, nodes); lesion masks used as guidance.
- **Handling missing data:** median imputation + Z-score for continuous variables; “Unknown” + one-hot encoding for categorical variables.

Methods: Task 2 RFS Prediction & Task 3 HPV Status Classification



5-Fold cross validation for RFS prediction (RT Dose map and Planning CT are not used)

5-Fold cross validation for HPV status classification

NVIDIA RTX A6000

Results: Task 3 HPV Status Classification

Table 5: HPV Status Classification Results

Fold	AUC	Balanced Accuracy	Specificity
Fold 1	0.9480	0.8532	1.0000
Fold 2	0.9578	0.8183	0.6667
Fold 3	0.9880	0.9361	0.9000
Fold 4	0.8979	0.7837	0.6154
Fold 5	0.9771	0.9541	1.0000
Average	0.9537	0.8691	0.8364
Validation	-	0.6076	0.9048

Validation refers to the leaderboard validation results, based on around 50 unseen cases.

Conclusion

- **Overfitting observed:** leaderboard validation metrics (esp. balanced accuracy) worse than cross-validation, likely due to high model complexity and class imbalance.
- **Potential solutions:** address class imbalance with advanced sampling; reduce model complexity via simpler architectures or regularization.
- **Informative features:** Studies have shown that primary tumor metrics (SUVmax, TotalSUV, MTV, TLG, TLRmax, TLRTLG) are predictive, especially for identifying HPV-negative tumors.
- **Future focus:** emphasize these tumor features to improve HPV classification accuracy.

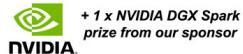
Acknowledgement



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