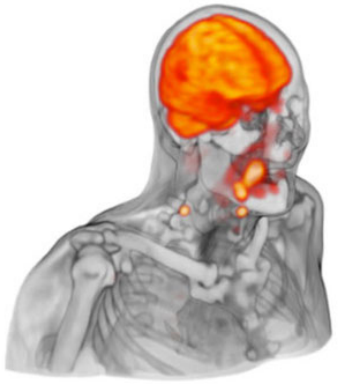
MICCAI2025 Daejeon REPUBLIC OF KOREA

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

NVIDIA + 1 x NVIDIA DGX Spark prize from our sponsor



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**

⇩

HECKTOR 2025 Challenge

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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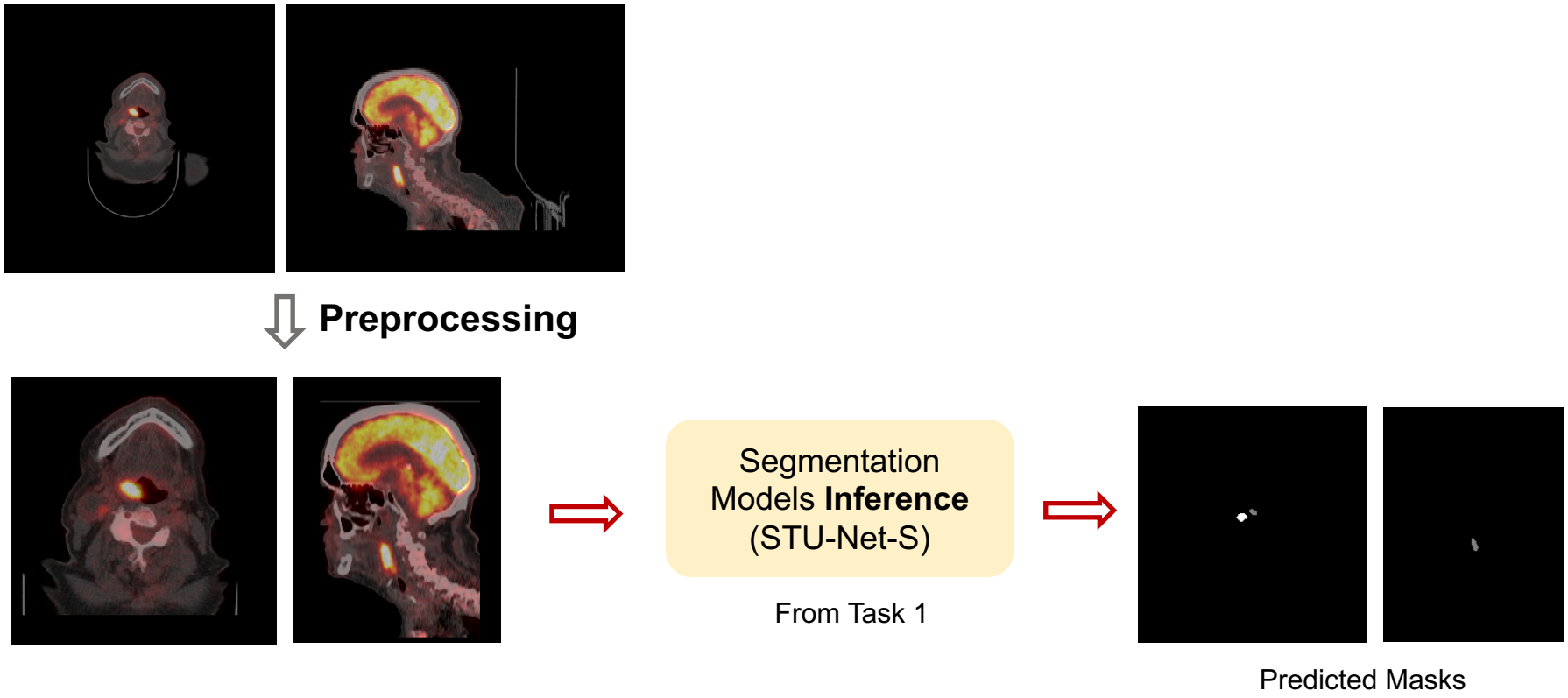
Data Preprocessing

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



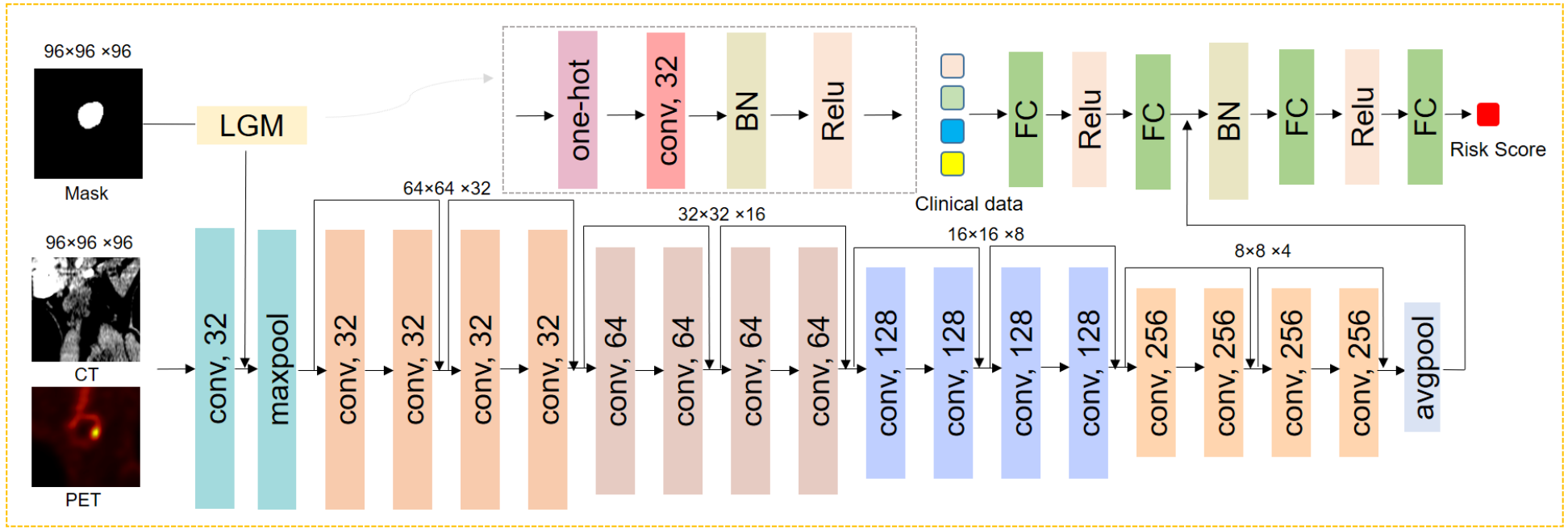
Data Preprocessing

- **Clinical variables**: demographics, treatment factors, and imaging biomarkers (MTV, NTV, T-SUV, N-SUV, TLG, NLG).

- **Imaging input**: 96 × 96 × 96 lesion-centered patch with CT (clipped & normalized), PET, and mask (predicte 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

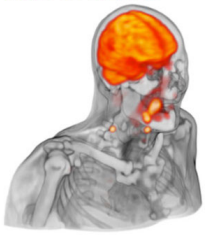
Fold	AUC	Balanced Accuracy	Specificity
Fold 1	0.9480	0.8532	1.0000
Fold 2	0.9578	0.8183	0.6667
Fold 3	0.9880	0.9361	0.9000
Fold 4	0.8979	0.7837	0.6154
Fold 5	0.9771	0.9541	1.0000
Average	0.9537	0.8691	0.8364
Validation	-	0.6076	0.9048

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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