

Supplementary material: MMFusion: Multi-modality Diffusion Model for Lymph Node Metastasis Diagnosis in Esophageal Cancer

1 Data preprocessing

The tabular data includes a total of 2,913 feature parameters: 9 clinical parameters, 47 hematological parameters, and 2,857 radiomics parameters. The radiomics parameters were extracted using the Pyradiomics Python package, while the clinical and hematological parameters were collected from clinical examinations. For the clinical and hematological parameters, univariate Cox regression was performed to select parameters with a p-value less than 0.2. For the radiomics parameters, XGBoost was utilized for feature preselection. Subsequently, the remaining parameters were combined for further selection using multivariate Cox regression with a p-value threshold of less than 0.7. In total, 54 tabular data parameters (19 radiomics parameters, 27 hematological parameters, and 8 clinical parameters) were finally selected for utilization. For the imaging data, histogram standardization and resampling were applied to both lymph node and primary tumor images. The masks for primary tumor and lymph node images were annotated and checked slice by slice by five expert physicians using ITK-SNAP. Practically, we selected the three largest lymph nodes ($90 \times 90 \times 22$; $68 \times 68 \times 16$; $48 \times 48 \times 8$) because the remaining lymph nodes were too small to provide sufficient information.

2 Basic dataset information and training implementation details

Table 1: Baseline characteristics of the study cohorts

Characteristic	Training cohort (n=947)	Validation cohort (n=136)	Test cohort (n=271)
OStime (%)			
≥ 35 month	443 (46.8)	65 (47.7)	112 (41.3)
< 35 month	504 (53.2)	71 (52.2)	149 (54.9)
Age (%)			
≥ 70	560 (59.1)	75 (55.1)	166 (61.2)
< 70	387 (40.8)	61 (44.8)	105 (38.7)
Sex (%)			
male	791 (83.5)	112 (82.3)	227 (83.8)
female	156 (16.4)	24 (17.6)	44 (16.2)
KPS (%)			
G1	1 (0.1)	1 (0.7)	0 (0.0)
G2	528 (55.7)	66 (48.5)	145 (53.5)
G3	414 (43.7)	68 (50.0)	124 (45.8)
G4	4 (0.4)	1 (0.7)	2 (0.7)

Table 2: Training and implementation details

Type	Parameters	Value
	GPU	NVIDIA RTX 3090
	Batch size	12
	Optimizer	Adam
	Weight decay	$5e - 4$
	Learning rate	$1e - 4$
	Epochs	100
	Scheduler	Cosine Annealing
Overall	Restart epoch	80
	Min learning rate	$1e - 5$
	Augmentation	RandomNoise (p=0.4) RandomBiasField (p=0.3) RandomFlip (p=0.6) RandomMotion (p=0.2)
	Layers of GAT	1
	Backone of CNN	ResNet50
	Guidance model warm-up training epochs	50
	Masking ratio	15%
	timesteps	10
CTD	β_1	0.01
	β_T	0.95