Multimodal Disease Progression Modeling via Spatiotemporal Disentanglement and Multiscale Alignment

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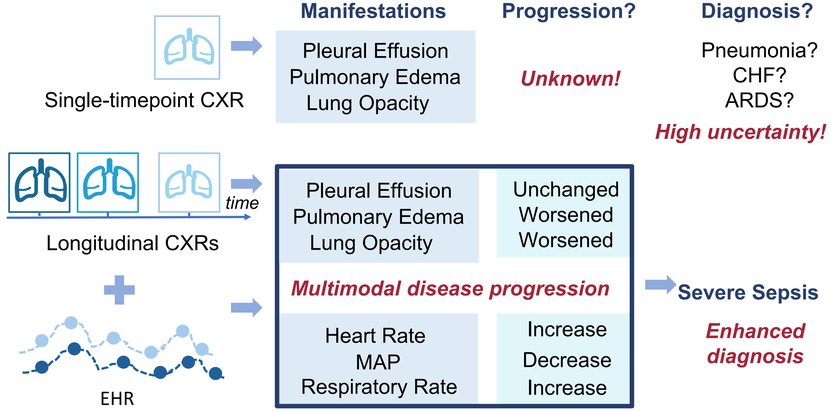
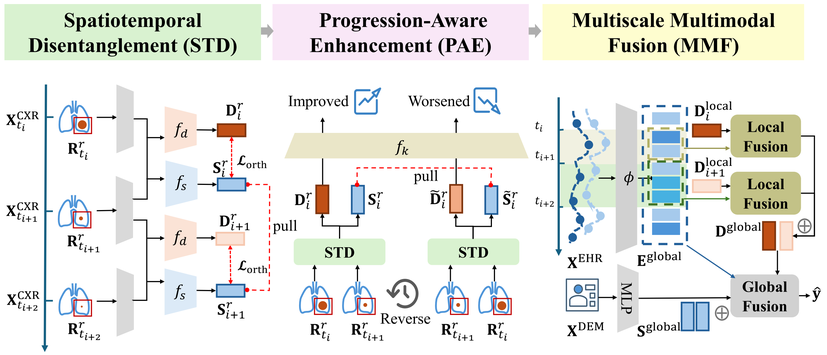
Motivation

A real case from MIMIC:

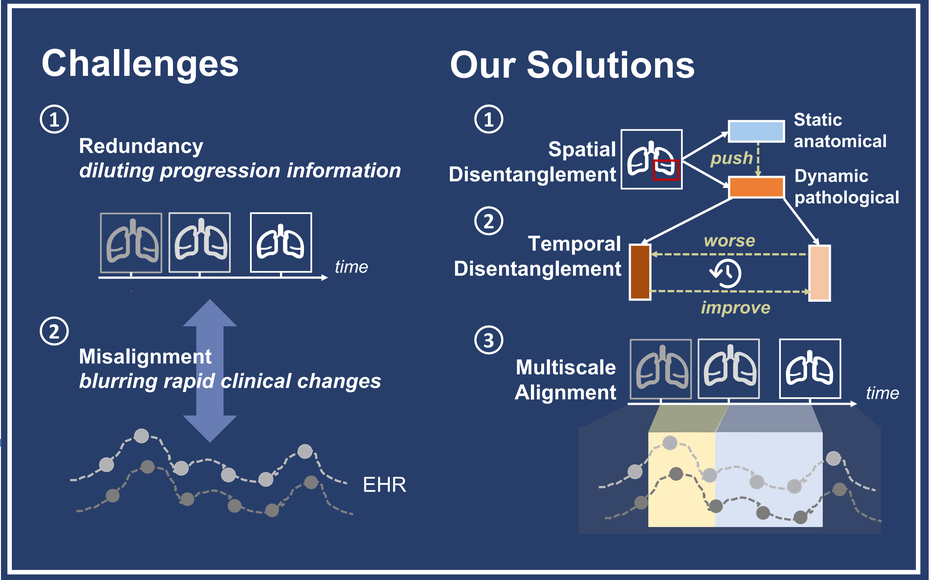


Method: DiPro



TL; DR.

DiPro disentangles static anatomy and dynamic pathology from *longitudinal CXRs* and aligns them with *EHRs* across timescales for precise **disease progression modeling**.



Key Insights:

- **Disentangle** Dynamic from Static Representations
- Incorporate **Progression-Direction Awareness**
- **Multiscale Fusion** of Longitudinal Multimodal Data

Code

Paper

The Hong Kong Polytechnic University 香港理工大學
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Neural Information Processing Systems

Results

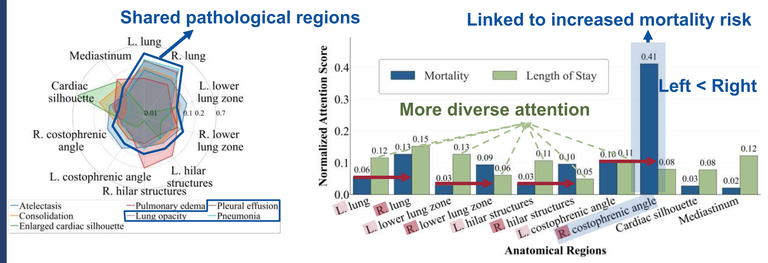
Disease Progression Identification

Method	Precision	Recall	F1	AUPRC	AUROC
Unimodal Methods (CXR)					
CheXRelNet [14]	0.395±0.015	0.392±0.010	0.389±0.010	0.394±0.010	0.574±0.011
CheXRelFormer [33]	0.389±0.044	0.379±0.033	0.354±0.032	0.372±0.023	0.551±0.041
SDPL [13]	0.408±0.006	0.406±0.020	0.393±0.010	0.417±0.032	0.609±0.031
DiPro (ours)	**0.475±0.004**	**0.452±0.011**	**0.453±0.009**	**0.468±0.013**	**0.651±0.016**
Multimodal Methods					
UTDE [19]	0.481±0.017	0.462±0.002	0.449±0.005	0.472±0.014	0.659±0.011
UMSE [20]	0.353±0.011	0.361±0.009	0.352±0.013	0.364±0.006	0.544±0.004
MedFuse [17]	0.423±0.049	0.413±0.045	0.409±0.042	0.422±0.040	0.530±0.030
DrFuse [18]	0.442±0.009	0.461±0.007	0.429±0.010	0.438±0.003	0.628±0.002
DiPro (ours)	**0.484±0.008**	**0.471±0.024**	**0.466±0.018**	**0.478±0.018**	**0.664±0.013**

General ICU Prediction

Method	CXR Used: Last	CXR Used: Long.	Mortality: AUPRC	Mortality: AUROC	Length of Stay: Kappa	Length of Stay: ACC
UTDE [19]	✓		0.717±0.019	0.887±0.004	0.160±0.016	0.381±0.013
		✓	0.710±0.019	0.887±0.012	0.195±0.031	0.400±0.021
UMSE [20]	✓		0.722±0.039	0.896±0.012	0.217±0.013	0.419±0.010
		✓	0.712±0.028	0.891±0.011	0.204±0.019	0.410±0.013
MedFuse [17]	✓		0.686±0.018	0.869±0.011	0.213±0.012	0.413±0.004
		✓	0.716±0.018	0.881±0.005	0.210±0.039	0.412±0.027
DrFuse [18]	✓		0.709±0.012	0.865±0.014	0.114±0.048	0.338±0.041
		✓	0.684±0.008	0.854±0.017	0.142±0.014	0.360±0.011
DiPro (Ours)		✓	**0.742±0.003**	**0.897±0.002**	**0.248±0.008**	**0.440±0.007**

Averaged attention weights of CXR regions in different tasks



(a) Disease Progression Identification (b) General ICU Prediction