ORID: Organ-Regional Information Driven Framework for Radiology Report Generation (Supplementary Material)

Tiancheng Gu[♥,∗] **Kaicheng Yang**[♠∗]
Xiang An[♠], **Ziyong Feng**[♠], **Dongnan Liu**[♥], **Weidong Cai**[♥†]
[♥]University of Sydney [♠]DeepGlint

tigu8498@uni.sydney.edu.au, kaichengyang@deepglint.com

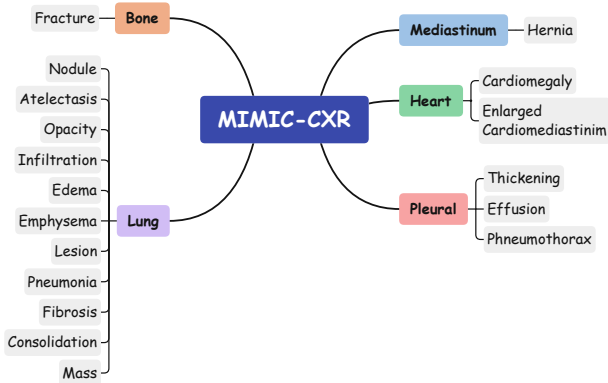## A. Appendix

A.1. Disease Symptom Graph

Figure 1. The symptom graph summarizes the related diseases for each organ in the MIMIC-CXR dataset.

Fig. 1 illustrates the detailed knowledge graph of disease symptoms derived from prior disease captions. This graph, referenced from [2], was constructed based on a professional analysis of the relationships between organs and their corresponding diseases as observed in radiology images. Utilizing this graph, we developed the instruction-tuning dataset and the adjacency matrix for the Graph Neural Network (GNN).

A.2. Benchmark Information

Table 1 presents comprehensive information on the two benchmark datasets employed to evaluate our ORID framework. The data indicate that the MIMIC-CXR dataset encompasses a greater number of cases compared to the IU-Xray dataset.

DATASET	IU-XRAY [1]			MIMIC-CXR [3]		
	Train	Val.	Test	Train	Val.	Test
IMAGE	5.2K	0.7K	1.5K	369.0K	3.0K	5.2K
REPORT	2.8K	0.4K	0.8K	222.8K	1.8K	3.3K
PATIENT	2.8K	0.4K	0.8K	64.6K	0.5K	0.3K
AVG. LEN.	37.6	36.8	33.6	53.0	53.1	66.4

Table 1. The specifications of two benchmark datasets that will be utilized to test the ORID model.

ORGAN MASK	NUM.	REGION	TOTAL MASK
Lung lobes	5		
Lung zones	8	Lung	
Lung halves	2		
Heart region	6	Heart	
Mediastinum	6	Mediastinum	
Diaphragm	3		159
Ribs	46	Bone	
Ribs super	24		
Trachea	2		
Vessels	6	Pleural	
Breast Tissue	2		
...	...	...	

Table 2. The specific information of masks generated by the CXAS model [4], as well as the mask images we ultimately used.

A.3. Mask Information

Table 2 provides specific details regarding the small organ masks included for each organ set. Furthermore, the visualization of these mask sets alongside the original images is presented in Fig. 2.
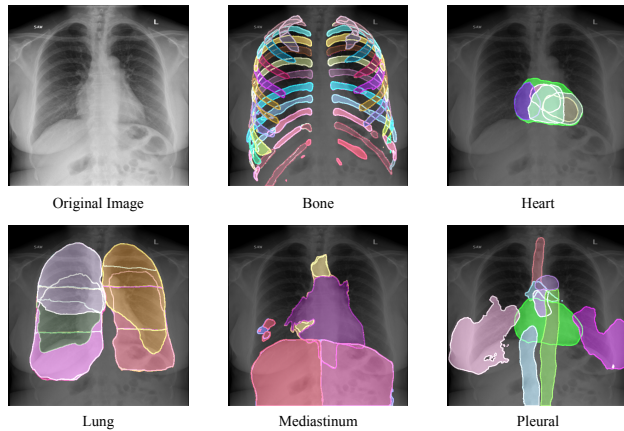
Figure 2. The visualization of the organ mask sets with the original image. Due to each organ region corresponding to several small organ parts, the different color means different part organ mask images in its corresponding regions.

A.4. Instruction-tuning Dataset

Fig. 3 presents examples from the instruction-tuning dataset. Notably, each image is accompanied by more than four question-answer pairs pertaining to various organs.

A.5. Case Study

We have shown the results of our ORID framework generated compared with that of ground truth in Fig. 4. We have also marked the pleural, heart, lung, bone, and mediastinum in different colors. More specifically, Example 1 shows the disease symptoms related to the heart and lungs; Example 2 shows the disease symptoms related to the heart.

References

[1] D. Demner-Fushman, M. D. Kohli, M. B. Rosenman, S. E. Shooshan, L. Rodriguez, S. Antani, and C. J. McDonald. Preparing a collection of radiology examinations for distribution and retrieval. *Journal of the American Medical Informatics Association*, 2016. 1

[2] Z. Huang, X. Zhang, and S. Zhang. Kiut: Knowledge-injected u-transformer for radiology report generation. In *CVPR*, 2023. 1

[3] A. E. Johnson, T. J. Pollard, S. J. Berkowitz, N. R. Greenbaum, M. P. Lungren, C. Y. Deng, and S. Horng. Mimic-cxr, a de-identified publicly available database of chest radiographs with free-text reports. *Scientific Data*, 2019. 1

[4] C. Seibold, A. Jaus, M. A. Fink, M. Kim, S. Reiß, K. Herrmann, and R. Stiefelhagen. Accurate fine-grained segmentation of human anatomy in radiographs via volumetric pseudo-labeling. *arXiv preprint arXiv:2306.03934*, 2023. 1
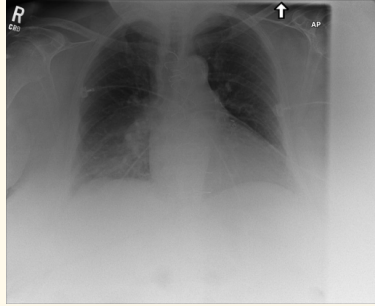
Q: What have you found in **heart**?

A: Heart size is moderately enlarged.

Q: What have you found in **bone**?

A: There is a fracture of superior sternotomy xxxx unchanged.

Q: What have you found in **pleural**?

A: There is no pleural effusion or pneumothorax.

Q: What have you found in **mediastinum**?

A: The pulmonary xxxx and mediastinum are within normal limits.

Q: What have you found in **lung**?

A: There is suspected right lower lobe airspace opacity xxxx demonstrated on the lateral study.

Q: What have you found in **heart**?

A: The heart is normal in size given the low lung volumes.

Q: What have you found in **bone**?

A: The bones are diffusely demineralized which limits assessment.

Q: What have you found in **pleural**?

A: There are possible small left pleural effusion.

Q: What have you found in **lung**?

A: Decreased lung volumes are noted causing crowding of the central bronchovascular structures.
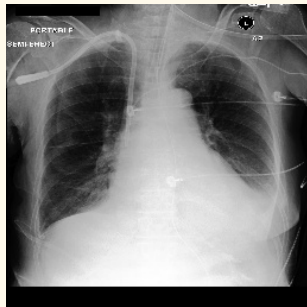
Q: What have you found in **heart**?

A: The heart is mildly enlarged, unchanged.

Q: What have you found in **pleural**?

A: Small left pleural effusion has slightly decreased.

Q: What have you found in **mediastinum**?

A: The mediastinum is not widened.

Q: What have you found in **lung**?

A: The right lung is clear. Moderate left lower lobe atelectasis is overall unchanged. No frank pulmonary edema.

Q: What have you found in **heart**?

A: Allowing for this, the cardiomediastinal silhouette is unchanged, with a heart size at the upper limits of normal.

Q: What have you found in **bone**?

A: No lucent or sclerotic rib fracture line or displaced rib fracture is detected.

Q: What have you found in **pleural**?

A: No focal consolidation or effusion is identified.

Q: What have you found in **lung**?

A: There is minimal bibasilar atelectasis, right-greater-than-left, which is slightly more pronounced than on ___.

Figure 3. The examples about the RRG instruction dataset to instruction tuning the LLaVA-Med

1

Ground Truth

the et tube is 35 cm above the carina . the ng tube tip is off the film at least in the stomach . right ij cordis tip is in the proximal svc . the heart size is moderately enlarged . no acute osseous abormality is seen. there is ill-defined vasculature and alveolar infiltrate right greater than left . this is markedly increased compared to the film from two hours prior and likely represents fluid overload .

ORID

heart size is enlarged . endotracheal tube terminates lingula and the apex of the clavicles . an orogastric tube ends below the diaphragm and side port ends approximately 65 cm below the gastroesophageal junction . no pulmonary vascular congestion is present . the mediastinal and hilar contours are normal . low lung volumes are present with probable mild bibasilar atelectasis . no pleural effusion or pneumothorax is seen . towards the right lung volumes remain low there is no pneumothorax . no acute osseous abnormality is seen .

2

Ground Truth

single ap portable view of the chest . no prior . the lungs are clear of large confluent consolidation . cardiac silhouette enlarged but could be accentuated by positioning and relatively low inspiratory effort . calcifications noted at the aortic arch . degenerative changes noted at the glenohumeral joints bilaterally . osseous and soft tissue structures otherwise unremarkable .

ORID

pa and lateral views of the chest . the heart size is not normal . the mediastinal and hilar contours are normal . the lungs are clear . there is no pleural effusion or pneumothorax . osseous and soft tissue structures otherwise unremarkable .

3

Ground Truth

as compared to the previous radiograph there is marked improvement in extent and severity of the pre-existing parenchymal opacities . unchanged borderline size of the cardiac silhouette . no pleural effusions . the nasogastric tube has been removed . endotracheal tube and the right internal jugular vein introduction sheath are in constant position .

ORID

left subclavian catheter terminates at the cavoatrial junction . endotracheal tube terminates anastomosis approximately 7 cm 7 cm above the carina . enteric tube is coiled in the stomach with its tip projecting over the gastric fundus . lung volumes are low . patchy opacity is seen in the mid lung field of which appears less likely representing aspiration infectious process or aspiration . no pleural effusion is seen . there is no evidence of pneumothorax.
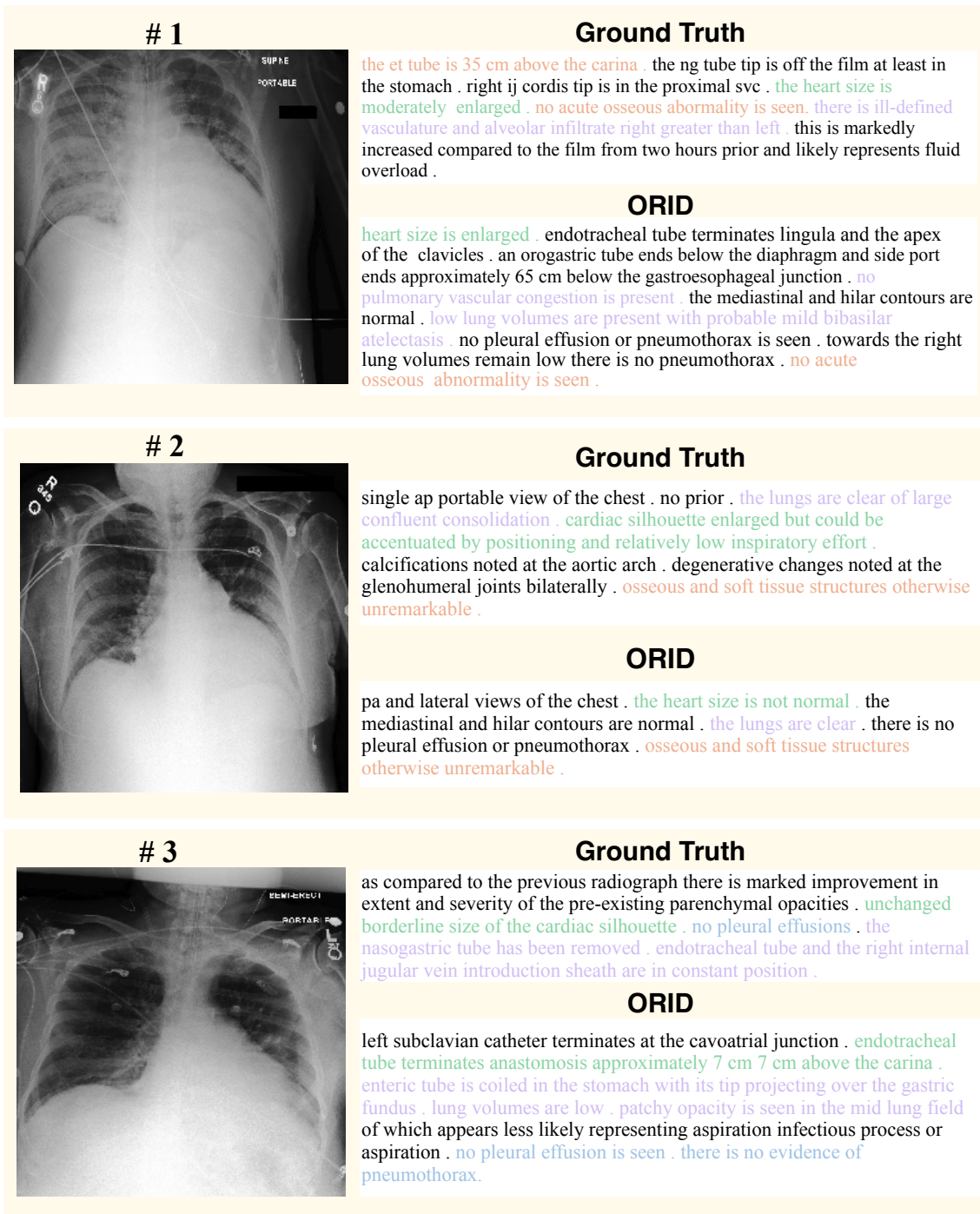
Figure 4. The visualization of prediction results by the ORID model. We specifically highlight the pleural, heart, lung, bone, and mediastinum with different colours in the radiology report.