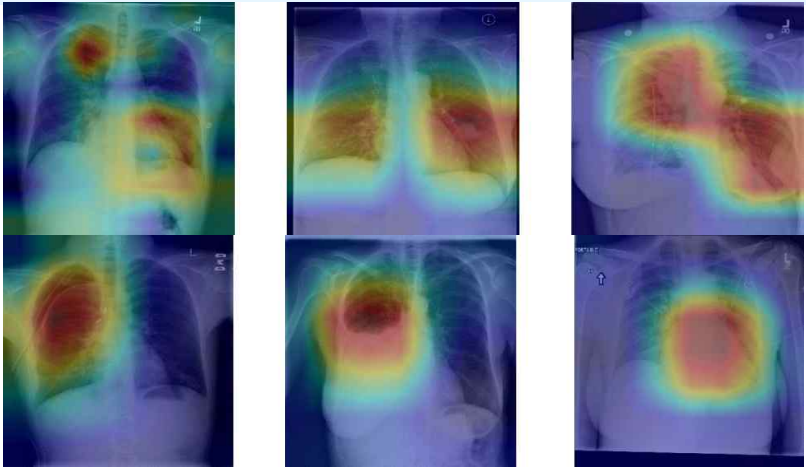
Clinical Interpretation of AI-Enhanced Chest Imaging: A Guide for Pulmonologists

서울대학교병원 영상의학과

임우현

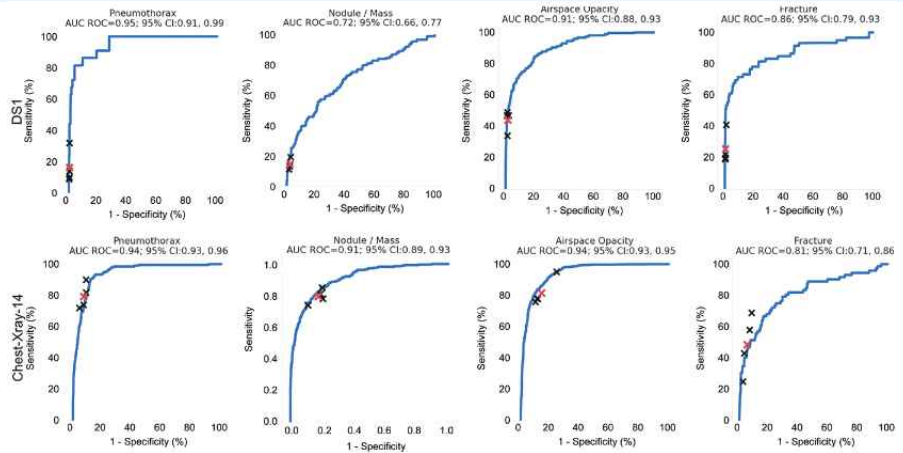
SNUH RADIOLOGY

Abnormality Detection



Rajpurkar et al. arXiv:1711.05225

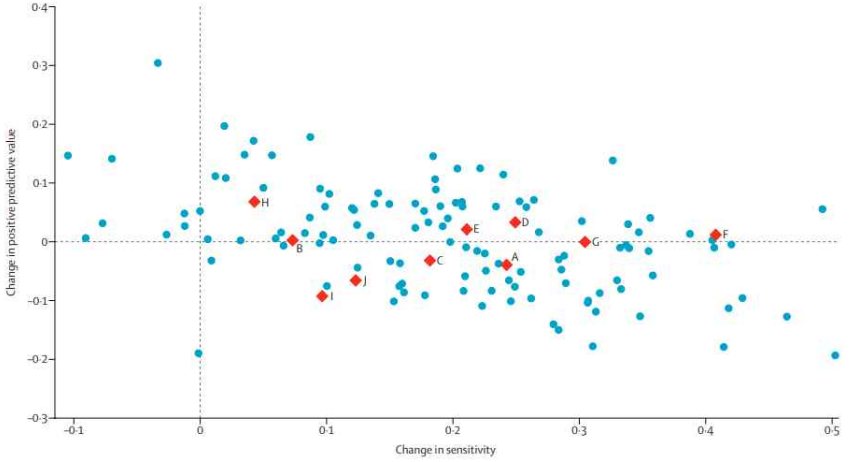
Performance: Standalone?



SNUH RADIOLOGY

Majkowska et al. Radiology 2020;294:421–431

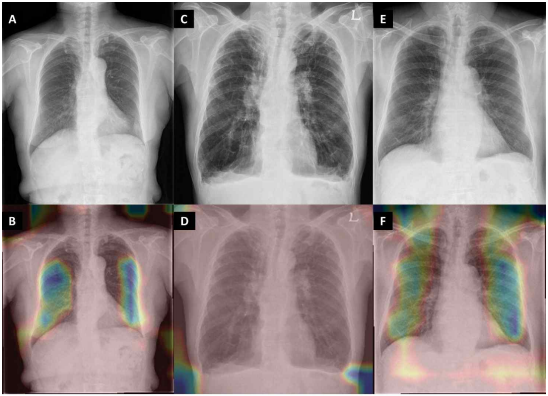
Performance: Human–AI Collaboration?



SNUH RADIOLOGY

Seah et al. Lancet Digit Health 2021;3:e496–506

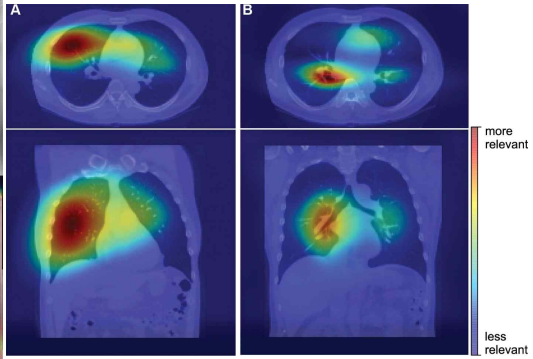
Prediction: CXR vs. CT, Survival vs. PFT



True Positive
Censored after 3698 days
$DLSP_{CXR}$ output for 5yr survival: 85.2%

True Negative
Died after 844 days
$DLSP_{CXR}$ output for 5yr survival: 29.1%

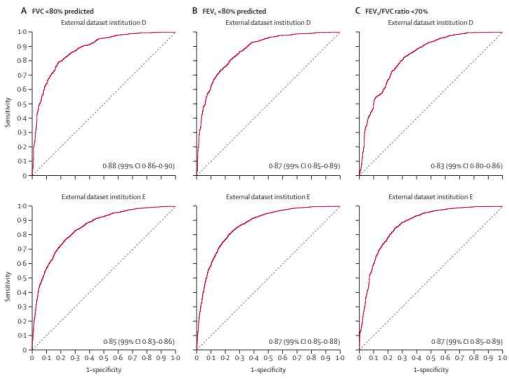
False Positive
Died after 1223 days
$DLSP_{CXR}$ output for 5yr survival: 80.1%

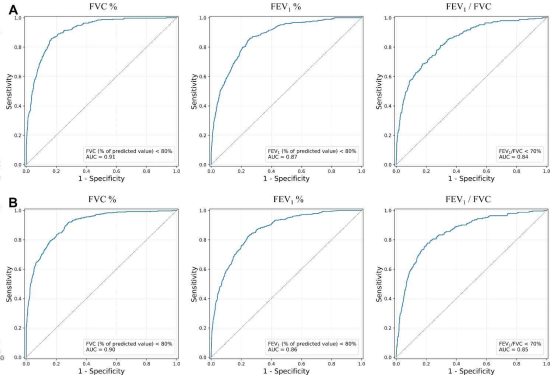


SNUH RADIOLOGY

Nam et al. Radiology 2022;305:199–208
Park et al. Radiology 2023;307:e221488

Prediction: CXR vs. CT in PFT

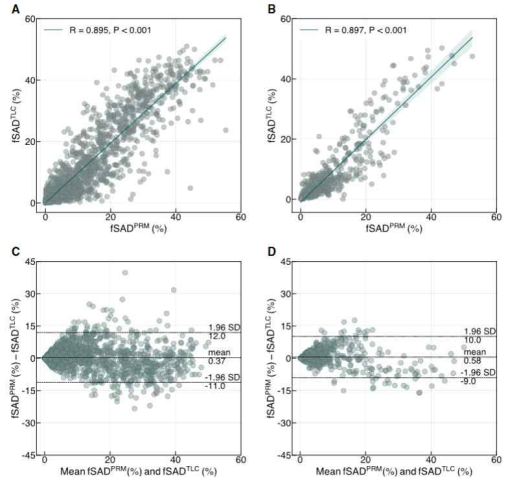


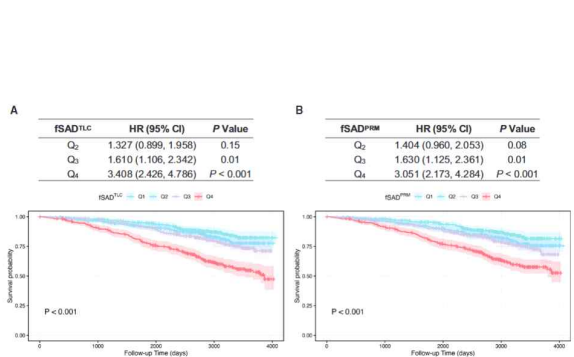


SNUH RADIOLOGY

Ueda et al. Lancet Digit Health 2024;6:e580–588
Park et al. Radiology 2023;307:e221488

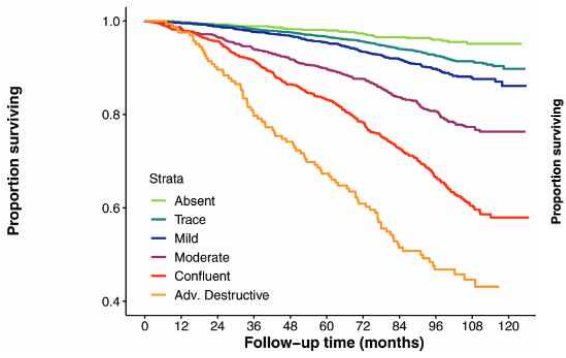
fSAD: Insp/Exp vs. Insp Only

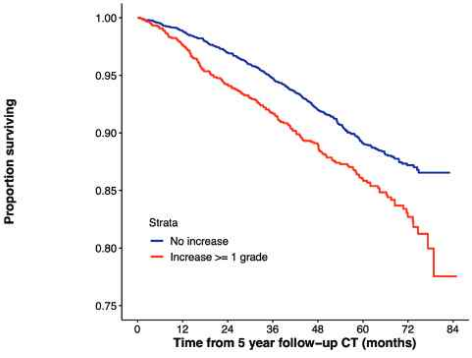




Chaudhary et al. Am J Respir Crit Care Med 2025;211:1185–1195

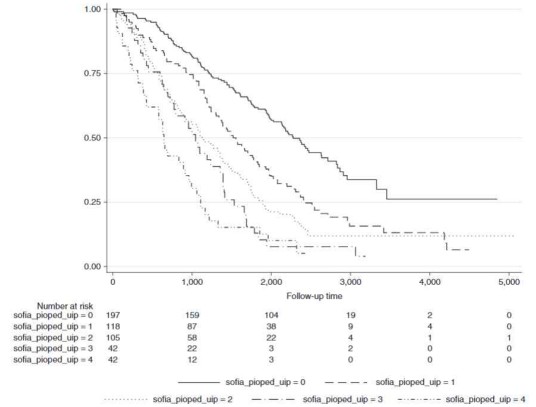
Emphysema: Visual Assessment

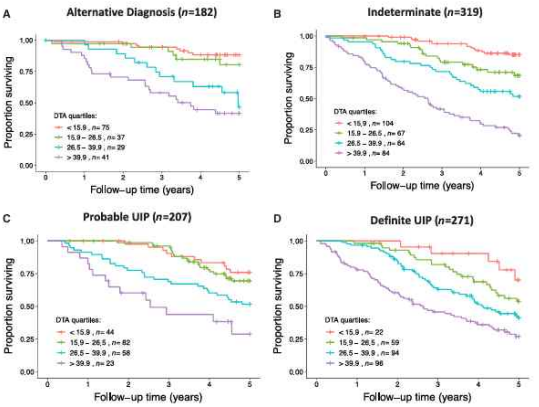




Humphries et al. Radiology 2020;294:434–444
Oh et al. Radiology 2022;304:672–679

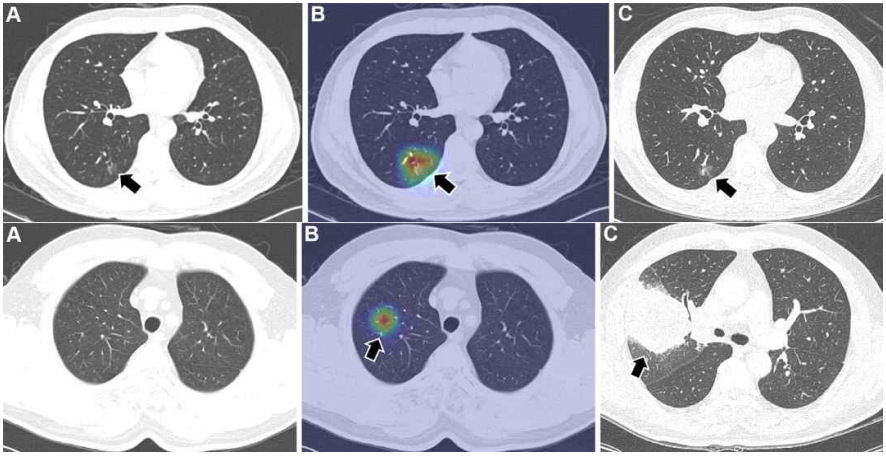
ILD: Pattern vs. Extent





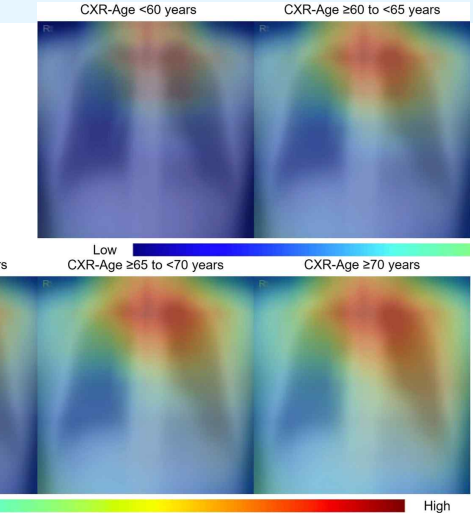
Walsh et al. Am J Respir Crit Care Med 2022;206:883–891
Oh et al. Ann Am Thorac Soc 2024;21:218–227

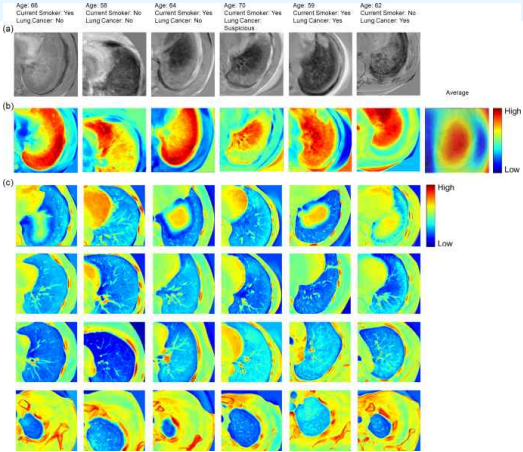
Prediction: Current Status vs Future Event



Lee et al. Radiology 2025;316:e243393

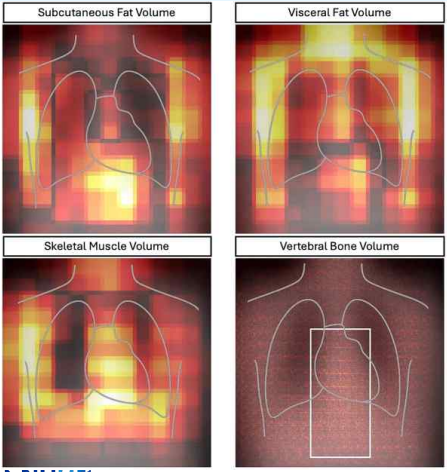
Biological Age Assessment

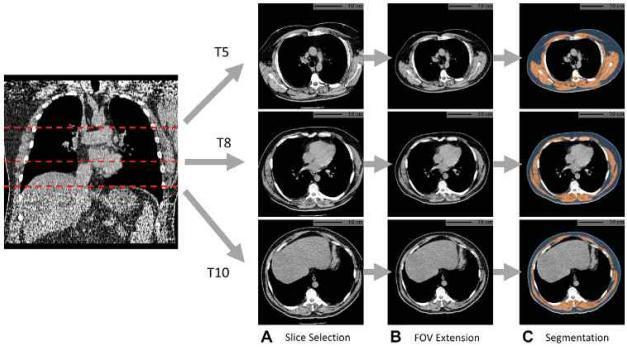




Lee et al. Radiology: Artificial Intelligence 2024;6:e230433
Azarfar et al. Int J Comput Assist Radiol Surg 2024;19:119–127

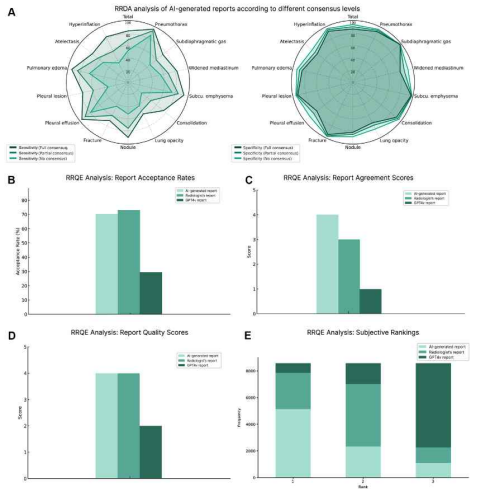
Opportunistic Screening: Body Composition

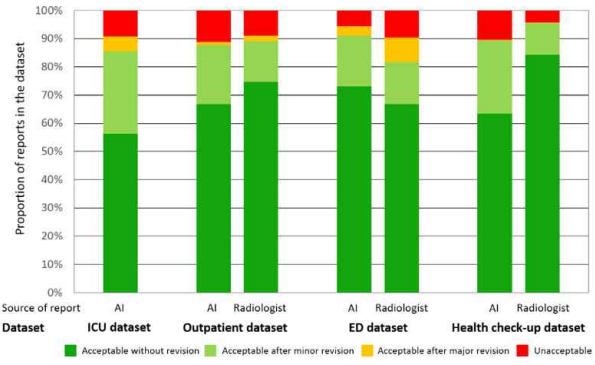




Alipour et al. Radiol Adv 2025;2:umaf035
Xu et al. Radiology 2023;308:e222937

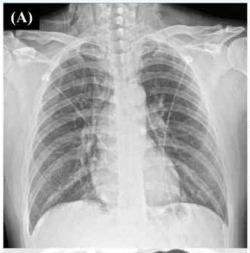
Automated Reporting Using VLM





Hong et al. Radiology 2025;314:e241476
Hwang et al. Radiology 2025;316:e250568

Automated Reporting Using VLM



Radiologist:
Pneumomediastinum with subcutaneous emphysema.
No active lung lesions.

Lingshu:
Findings:
The heart is normal in size. The mediastinum is unremarkable. The lungs are clear.
Impression:
No acute disease.

MedVersa:
Findings:
The lungs are clear. Cardiac silhouette is normal in size. There is no pleural effusion, pneumothorax or pulmonary edema. There is extensive subcutaneous emphysema. There is no free air under the diaphragm.
Impression:
Extensive subcutaneous emphysema without evidence of pneumomediastinum or pneumothorax. No acute cardiopulmonary process.

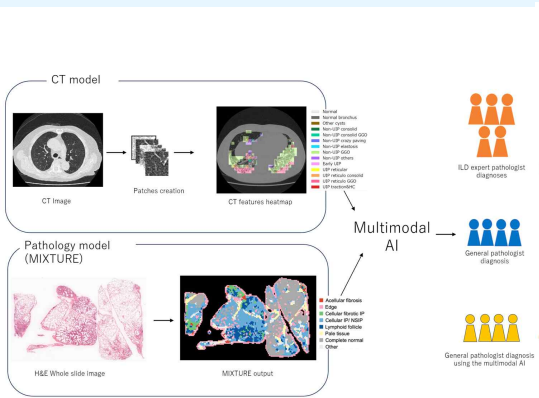
MAIRA-2:
Right chest tube has been removed. There is a small residual right apical pneumothorax. There is no evidence of mediastinal shift. No focal infiltrates are seen.

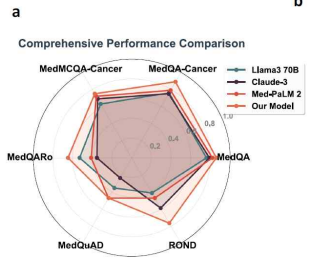
AIRead:
Pneumomediastinum.
Subcutaneous emphysema.

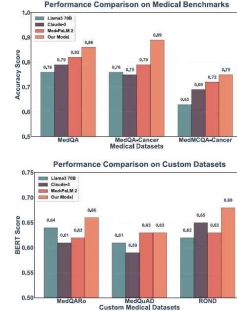
MedGemma:
Okay, here's a description of the chest X-ray based on the image provided:
Overall Impression:
The image shows a chest X-ray with the patient likely intubated and potentially sedated. The presence of lines and tubes suggests a hospital setting.
Key Findings:
* **Bones:** The ribs, clavicles, and scapulae are visible. There are no obvious fractures or dislocations.
* **Lungs:** The lungs appear relatively clear, with no obvious consolidation, effusions, or pneumothorax. However, the visualization of the lung parenchyma is limited due to the presence of the lines and tubes.
* **Heart:** The heart size appears within normal limits.
* **Mediastinum:** The mediastinum (the space between the lungs containing the heart, great vessels, trachea, etc.) appears unremarkable.
* **Lines and Tubes:** There are several lines and tubes present, including:
  * **Endotracheal Tube (ETT):** The ETT is visible in the trachea, likely in place to secure the patient's airway.
  * **Central Venous Catheter (CVC):** A CVC is visible, likely in the superior vena cava.
  * **Other lines:** There are other lines that are not clearly identified.
Limitations:
* **Limited Lung Visualization:** The presence of the lines and tubes obscures the visualization of the lung parenchyma, making it difficult to assess for subtle abnormalities.
* **Patient Positioning:** The patient's position may not be ideal for optimal visualization of the chest.
In summary, this chest X-ray shows a patient with lines and tubes in place, likely intubated. The lungs appear relatively clear, but the visualization is limited. Further evaluation may be needed to assess for any underlying pathology.
Disclaimer: This is a preliminary interpretation based on a single image. A complete evaluation requires clinical correlation and potentially additional imaging.

Lim and Lee et al. submitted

Multimodal AI, Agentic AI







c

A 70-year-old man presents to a medical clinic reporting blood in his urine and lower abdominal pain for the past few days. He is also concerned about urinary frequency and urgency. He states that he recently completed a cycle of chemotherapy for non-Hodgkin lymphoma. Which medication in the chemotherapy regimen most likely caused his symptoms?

A.Cytarabine **B.**Methotrexate **C.**Rituximab **D.**Cyclophosphamide

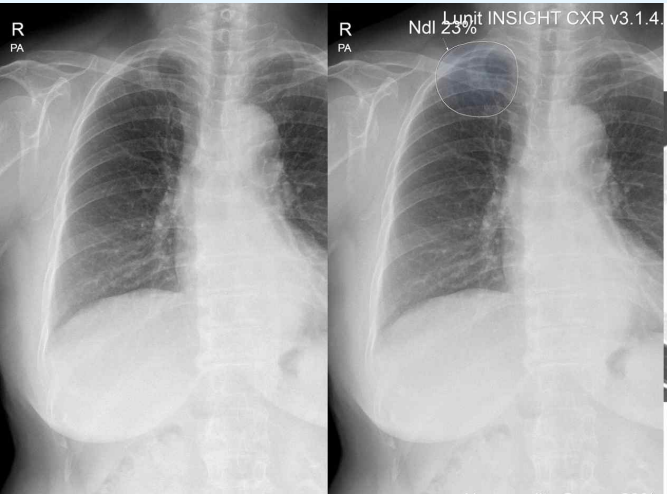
d

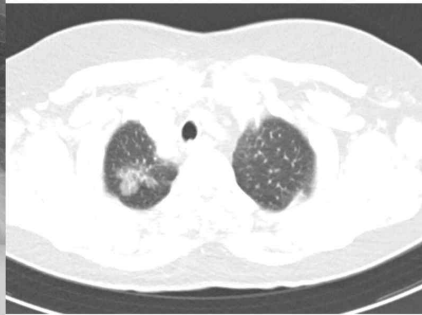
The answer is: **D**

Lami et al. Respirology 2025;30:726–735
Liu et al. NPJ Digit Med 2026;9:124

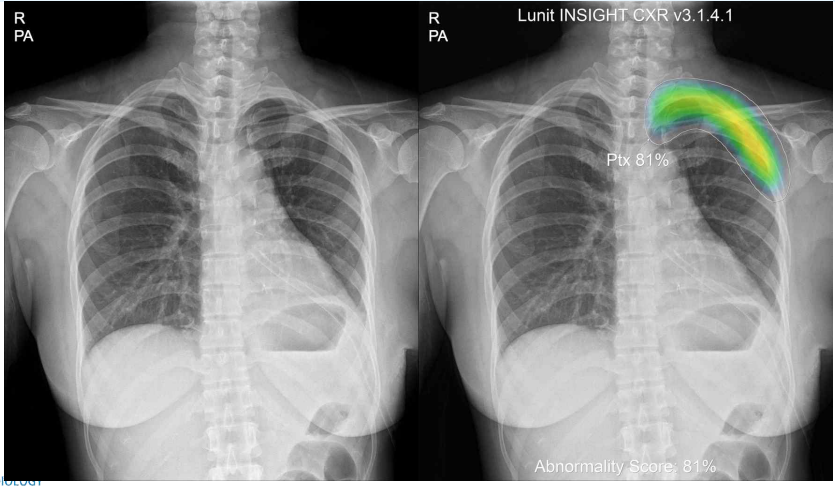
Limitations in AI Application

Detection

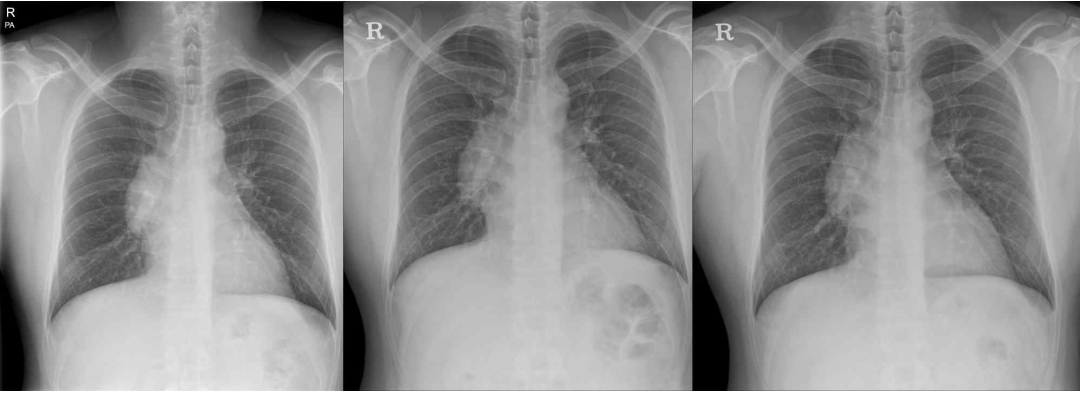




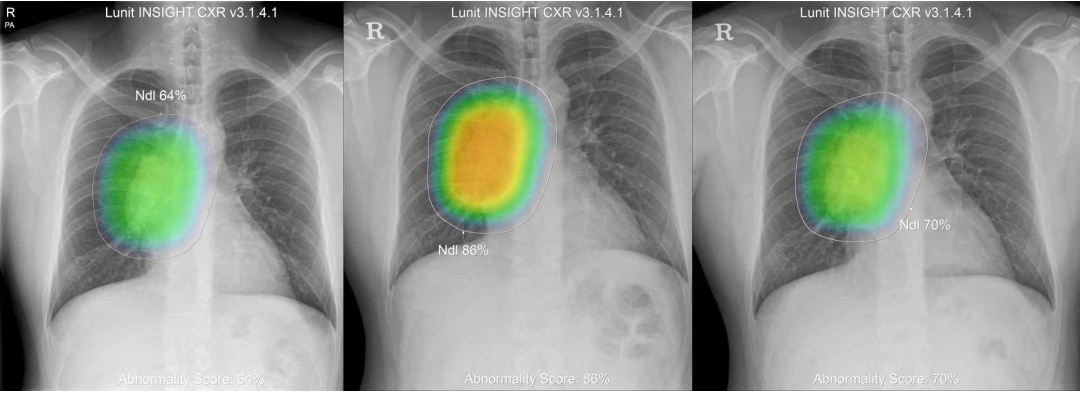
Detection



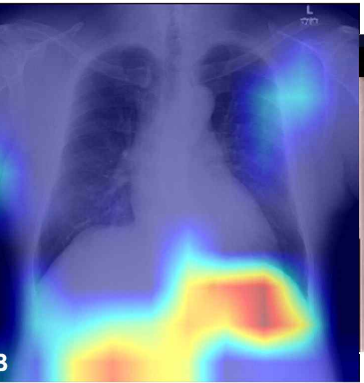
Model Output

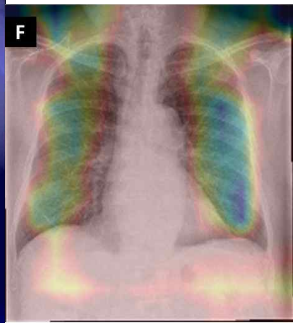


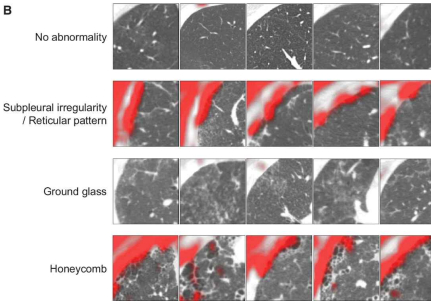
Model Output



Explainability

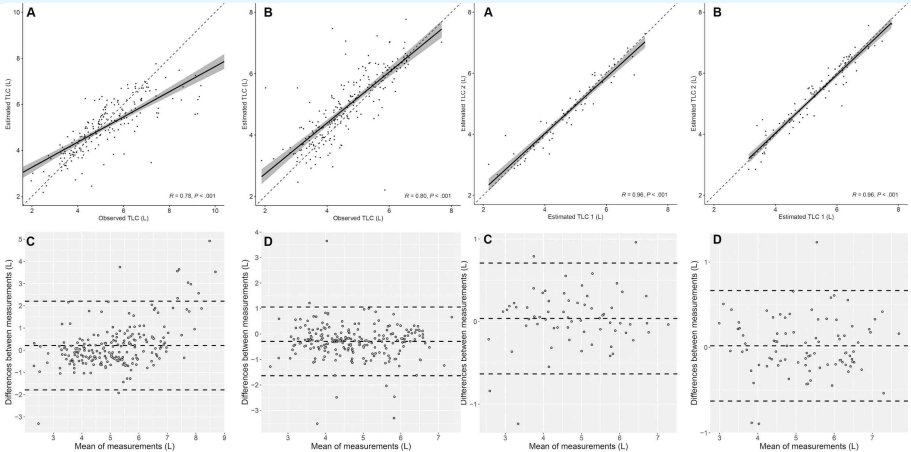






Ueda et al. Radiol Cardiothorac Imaging 2025;7:e240402
Nam et al. Radiology 2022;305:199–208
Humphries et al. Am J Respir Crit Care Med 2024;209:1121–1131

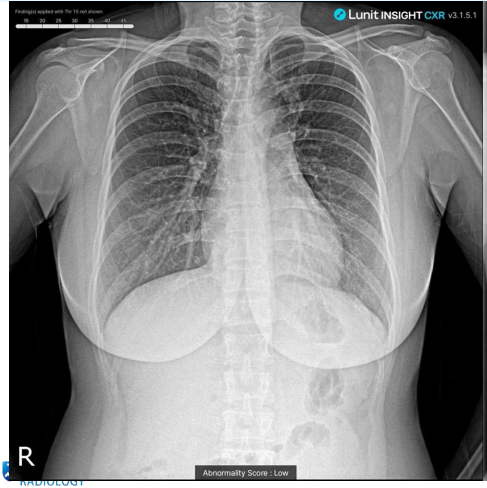
Correlation, Agreement, Repeatability

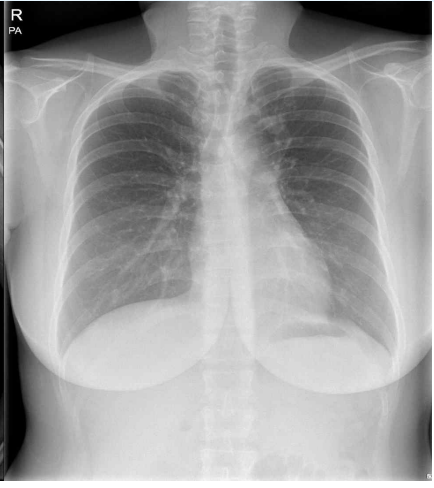


SNUH RADIOLOGY

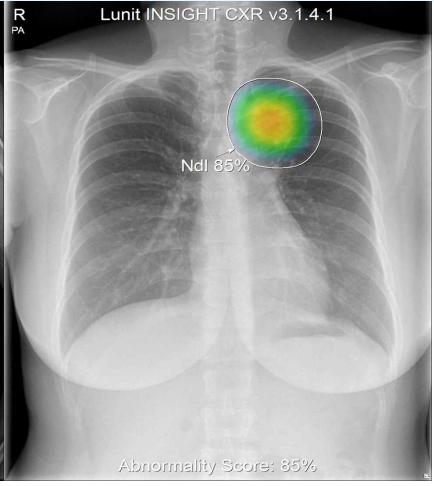
Kim et al. Radiology 2023;306:e220292

Domain Shift: CXR

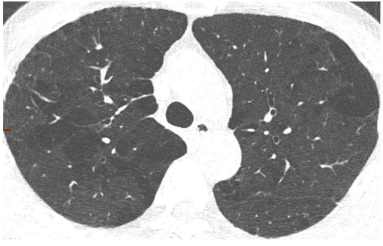


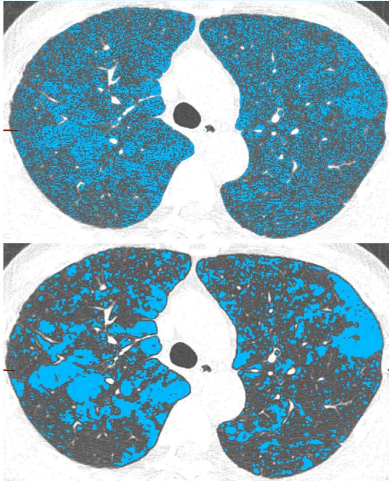


Domain Shift: CXR

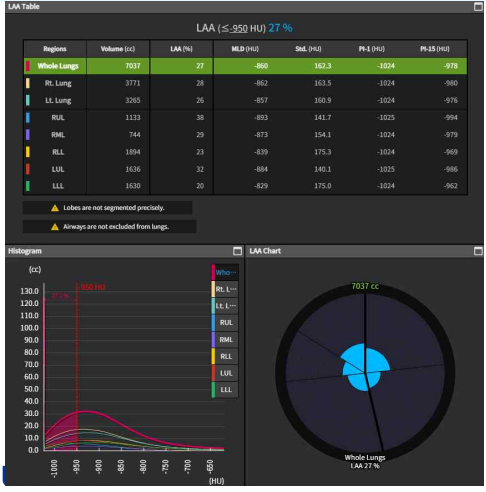


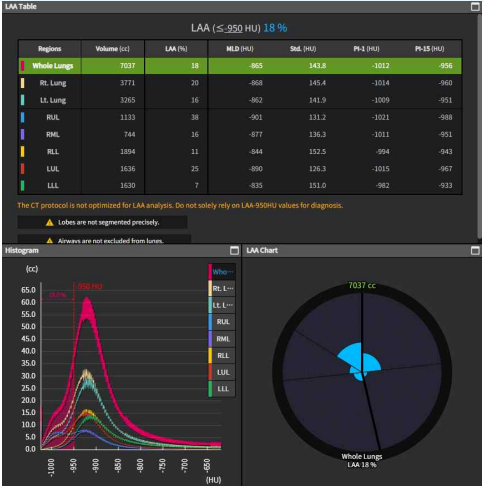
Domain Shift: Kernel



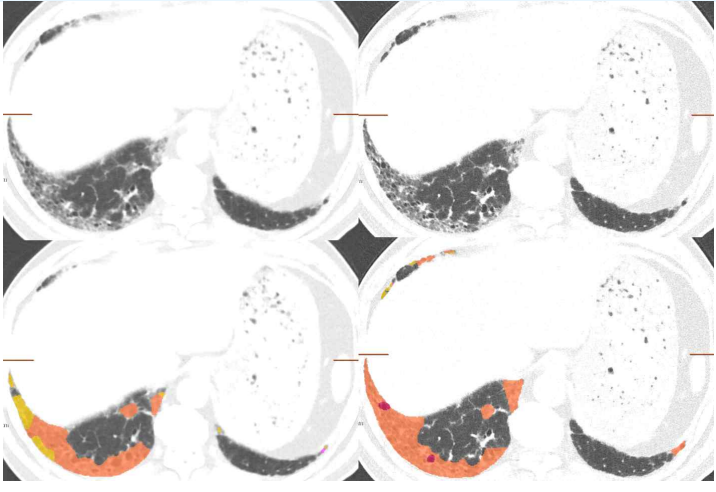


Domain Shift: Kernel

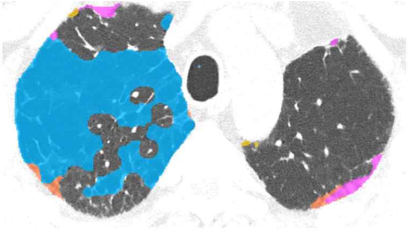


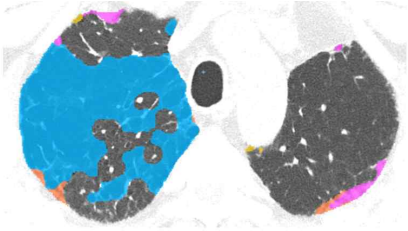


Domain Shift: Kernel



Domain Shift: Slice Thickness





Regions	Volume (cc)	Pattern H (%)	Pattern R (%)	Pattern G (%)	Pattern C (%)	Pattern E (%)	Pattern N (%)
Whole Lungs	3501	1	6	1	0	5	89
Rt. Lung	2239	2	7	1	0	7	85
Lt. Lung	1262	0	5	0	1	0	95
RUL	671	2	5	0	0	24	71
RML	451	4	3	1	0	0	94
RLL	1116	1	9	1	0	0	89
LUL	633	0	4	0	1	0	97
LLL	629	0	6	0	0	0	94

Regions	Volume (cc)	Pattern H (%)	Pattern R (%)	Pattern G (%)	Pattern C (%)	Pattern E (%)	Pattern N (%)
Whole Lungs	3511	2	6	1	0	5	88
Rt. Lung	2244	3	7	1	0	8	83
Lt. Lung	1266	0	5	0	1	0	95
RUL	673	4	5	0	1	26	68
RML	450	4	3	0	0	0	93
RLL	1121	1	10	1	0	0	89
LUL	633	0	4	0	1	0	96
LLL	633	0	6	0	1	0	94

Unmet Needs in AI for Radiology

- **Explainability:** Grad-CAM, transformer-based approach (attention)
- **Test–retest repeatability:** depth of inspiration, rotation; additional radiation
- **Domain shift:** imaging acquisition parameters; generalizability
- **Uncertainty:** confidence interval; PFT? imaging biomarker?
- **Data dependency:** label noise, dataset bias
- **VLM:** detection, segmentation, automated reporting; confidence, hallucination
- **Human–AI interaction:** particularly in VLM

Faghani et al. Radiology 2023;308:e222217
Kocak et al. Diagn Interv Radiol 2025;31:75–88
Nam et al. Korean J Radiol 2025;26:900–923
Kocak et al. Diagn Interv Radiol 2026 (ahead of print)

From Abnormality Detection to Agentic AI

- **Abnormality detection:** nodule, consolidation, pneumothorax, pleural effusion, etc
- **Quantification:** emphysema, ILD

- **Opportunistic screening:** body composition; CT > CXR
- **Triage, automated reporting:** emergency department

- **Imaging biomarker:** PFT prediction, biological age assessment
- **Multimodal AI:** simulation of MDD, lung cancer screening (agentic AI)

Thank You for Attention