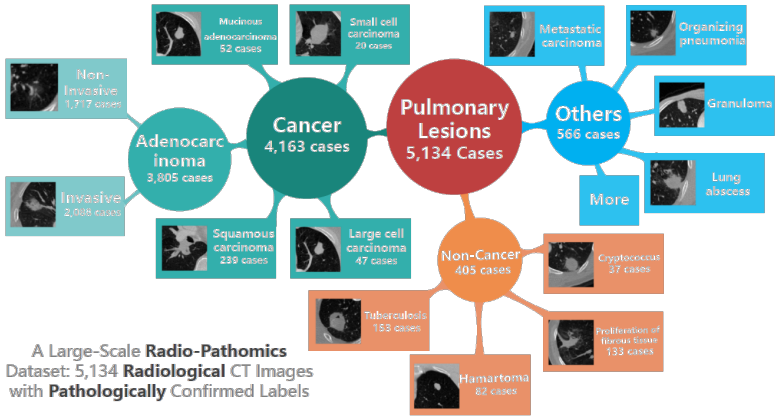
Motivation

How can we reduce the **annotation ambiguity** by human experts?

Use **pathologically confirmed** labels (clinical golden standard)!

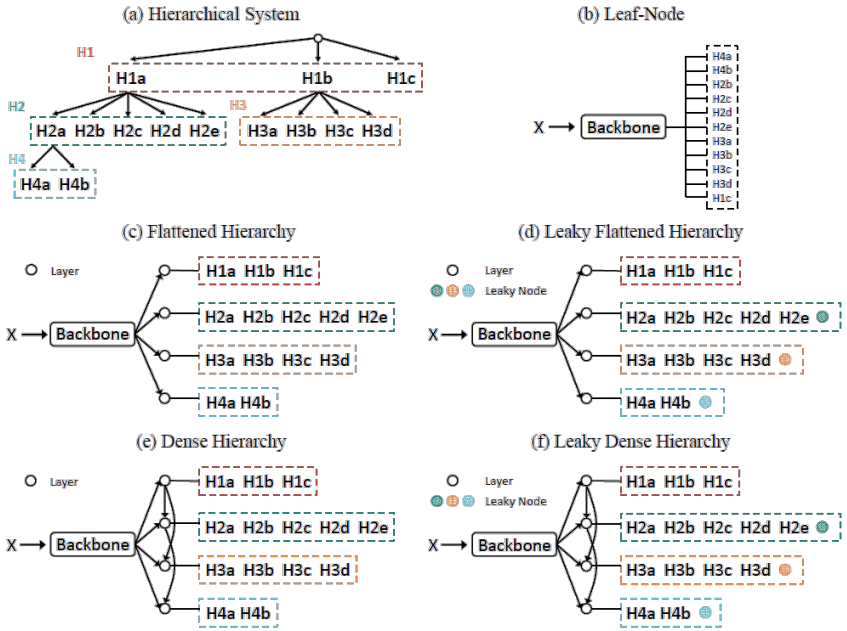


A Large-Scale **Radio-Pathomics** Dataset: 5,134 **Radiological** CT Images with **Pathologically** Confirmed Labels

Our in-house dataset **Pulmonary-RadPath**

- Large-scale
- Hierarchical
- Multi-Disease

Methodology



Take-Home:

- Learn each hierarchy with **separate head**
- Keep a **Leaky Node** as a virtual class for "*others*"
- Make **densely** connected **hierarchies**

Results

Methods	mAUC@H1	mAUC@H2	mAUC@H3	mAUC@H4	mAUC@L
Leaf-Node	68.9	86.9	76.5	43.8	80.7
Flattened Hierarchy	64.3	85.5	76.2	92.2	80.4
Leaky Flattened Hierarchy	74.1	87.3	70.0	92.4	81.9
Dense Hierarchy	66.1	87.3	**80.0**	93.0	81.1
Leaky Dense Hierarchy	**75.9**	**89.1**	79.9	**93.8**	**84.1**

Methods	H1a	H1b	H1c	H2a	H2b	H2c	H2d	H2e	H3a	H3b	H3c	H3d	H4a	H4b
Leaf-Node	69.3	67.8	66.6	87.1	86.8	86.2	76.4	74.6	70.6	71.6	88.0	**69.8**	55.3	31.0
Flattened Hierarchy	64.4	62.9	64.3	85.7	87.2	84.8	78.3	68.2	76.2	61.9	88.2	63.9	92.2	
Leaky Flattened Hier.	74.6	72.9	71.1	87.4	86.2	**92.8**	80.3	**81.9**	76.6	**78.3**	88.8	54.2	92.4	
Dense Hierarchy	66.2	67.2	64.6	87.5	87.2	89.0	**83.8**	75.0	77.8	69.9	**91.5**	69.6	93.0	
Leaky Dense Hierarchy	**76.4**	**76.9**	**71.5**	**89.2**	**90.4**	86.9	**83.8**	75.9	**79.5**	71.1	90.2	63.3	**93.8**	

The first **hierarchical multi-disease** classification system of pulmonary lesion developed **pathologically confirmed** labels.

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Hierarchical Classification of Pulmonary Lesions: A Large-Scale Radio-Pathomics Study

Jiancheng Yang *et al.* MICCAI 2020.