

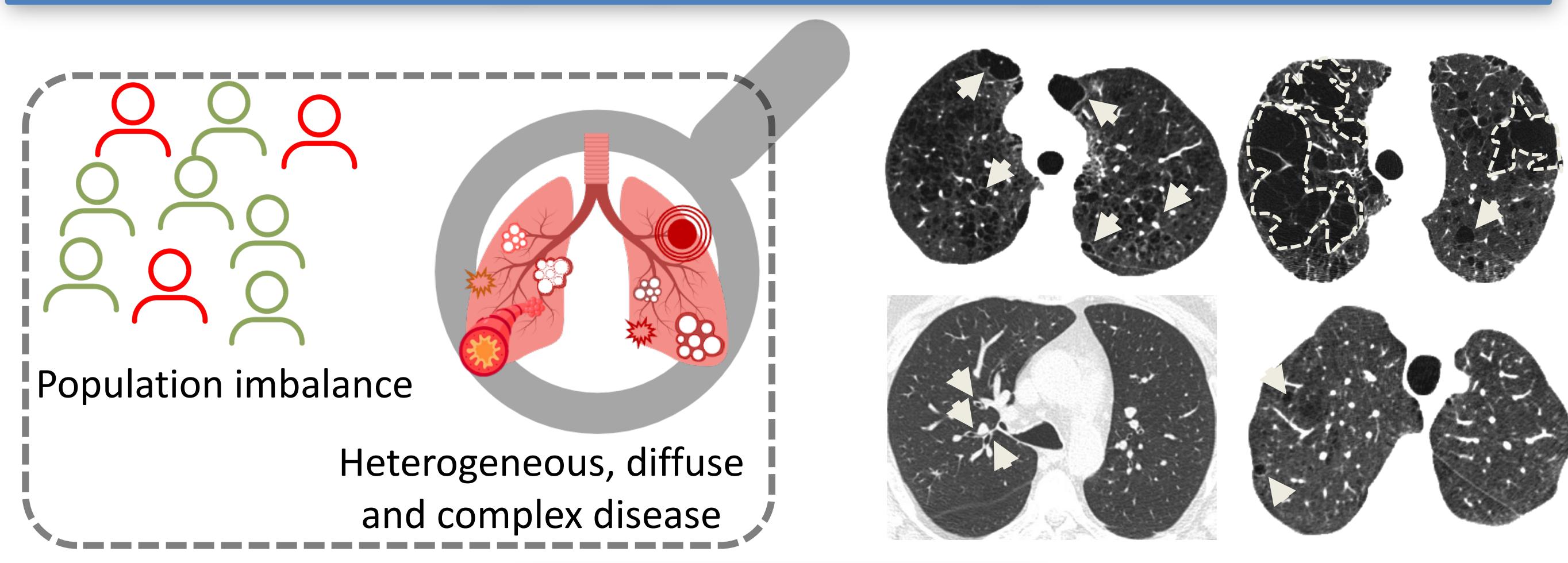
# cOOpD: Reformulating COPD classification on chest CT scans as anomaly detection using contrastive representations

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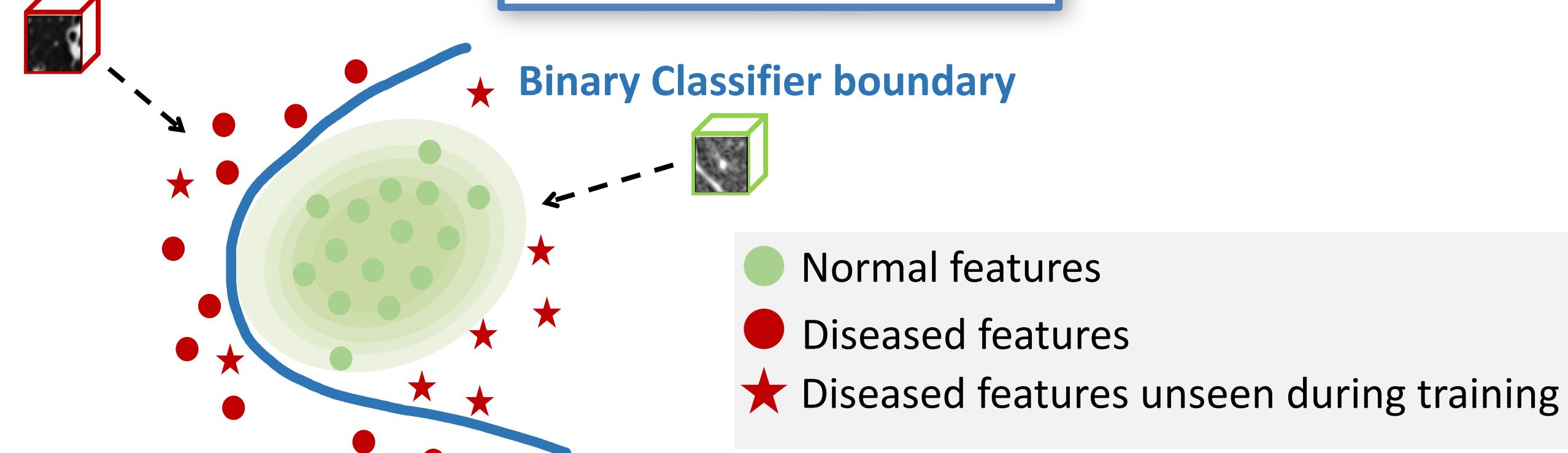
Making use of large, homogenous healthy populations to find diseased cases in unlabeled datasets via anomaly detection in the representation space

## Introduction

Chronic Obstructive Pulmonary Disease (COPD) appearance on CT challenges supervised binary classification.

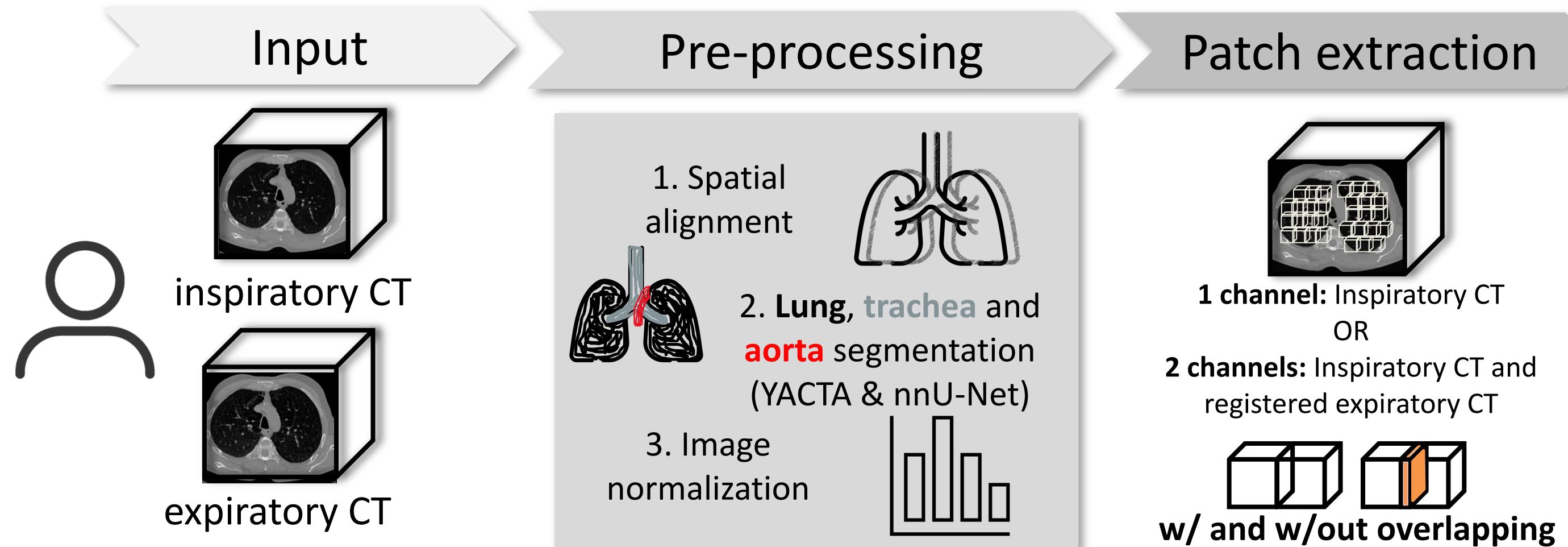


### Feature Space

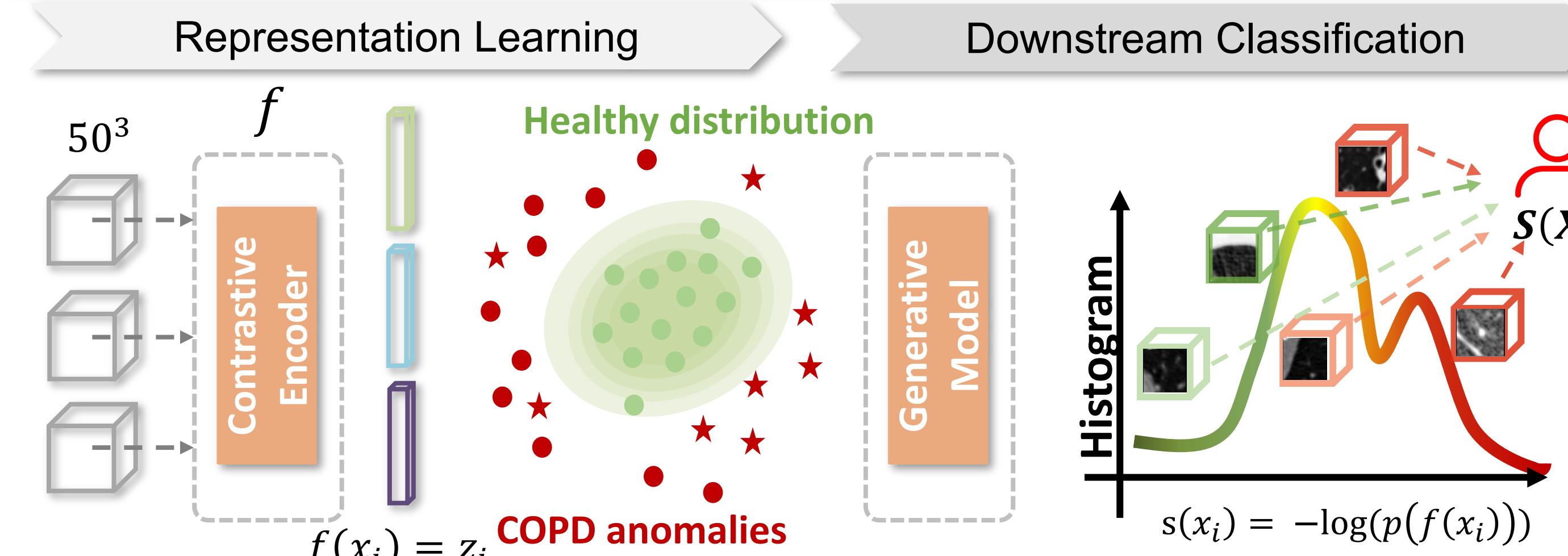


**Hypothesis:** Could COPD be more accurately detected if considered as an **anomaly** from the distribution of healthy lungs?

## Methods



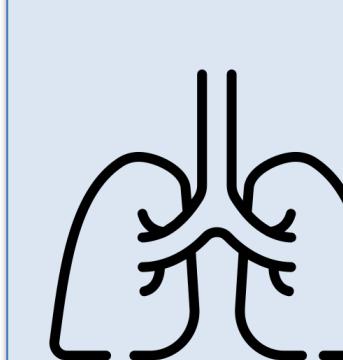
### cOOpD: COPD classification by Out-of-Distribution detection



Fitting Generative Models for representation of patches of a SimCLR like trained Encoder: ↓complexity of data-distribution.

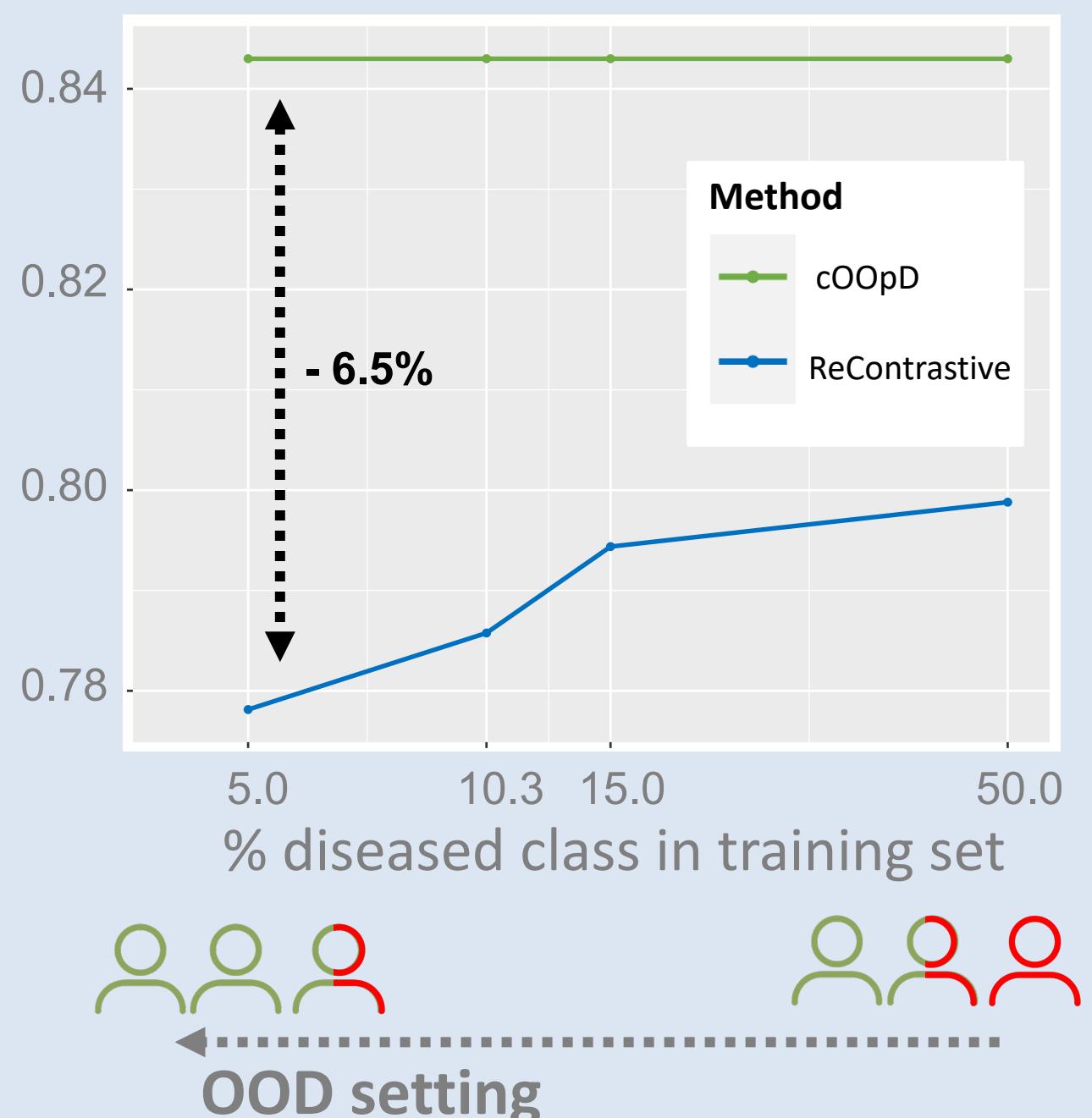
## Results

### Dataset



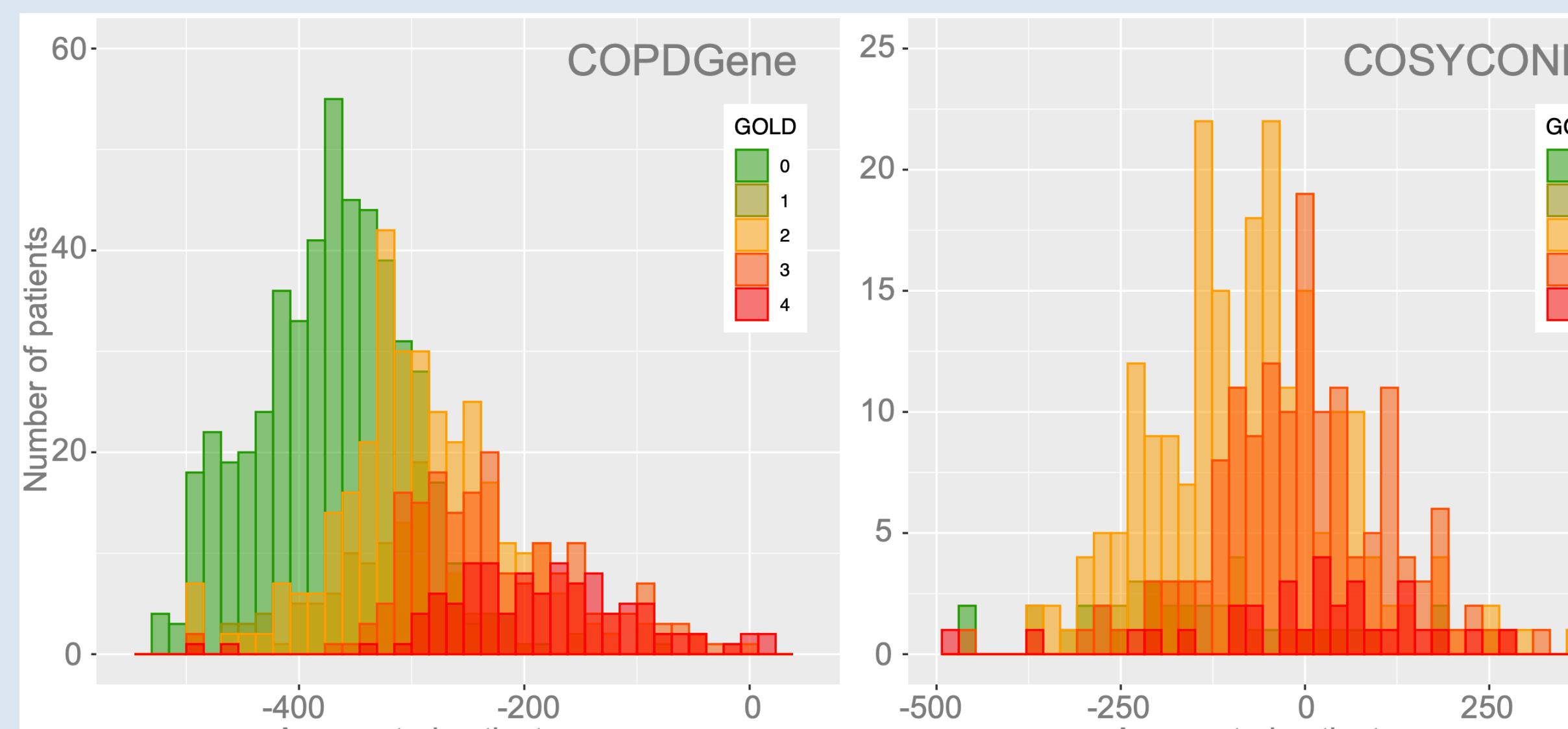
5244 from COPDGene (57% COPD)  
484 from COSYCONET (85% COPD)

### Real-world performance

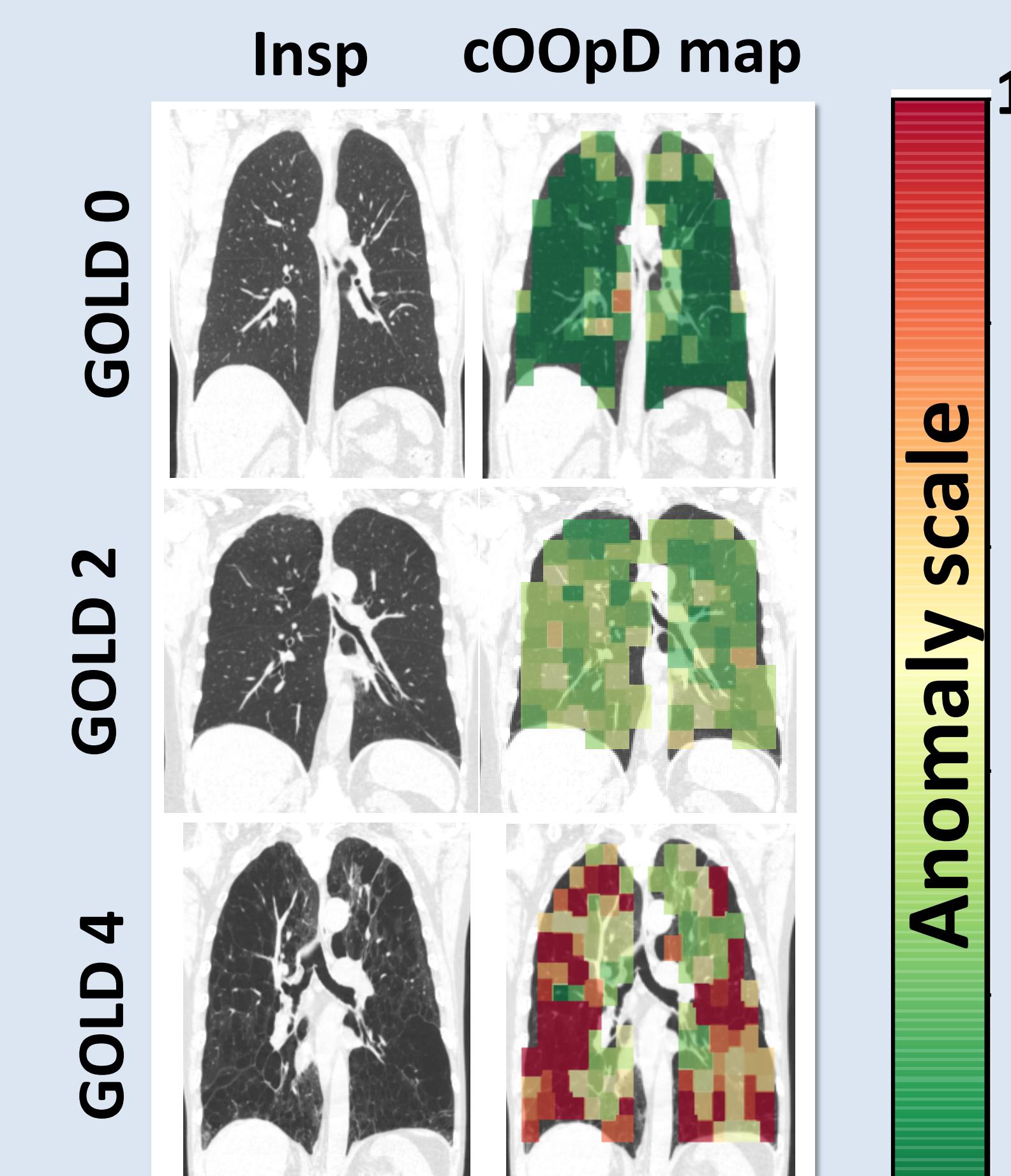


### Classifier evaluation in two large datasets

Input	Methods	COPDGene		COSYCONET	
		AUROC	AUPRC	AUROC	AUPRC
2D image	2D-CNN	55.6±2.5**	72.0±1.5**	57.0±8.0**	84.6±1.4**
	PatClass + RNN	76.1±0.2**	86.3±0.1**	56.2±0.7**	95.3±0.1**
	MIL + RNN	73.0±0.6**	84.5±0.5**	60.2±4.2*	95.7±0.4**
3D patch	MIL + Att	65.8±1.2**	80.9±0.8**	57.7±1.3**	95.1±0.2**
	ReContrastive (ours)	79.9±0.3**	88.5±0.2*	53.3±0.1**	95.0±0.1**
	cOOpD (ours)	84.3±0.3	89.7±0.2	67.9±0.7	96.5±0.4



### Visualization maps



## Discussion & Conclusion

- cOOpD demonstrates superior performance compared to SotA methods for COPD binary classification.
- Leveraging the contrastive latent space outperformed voxel-based classifiers.
- cOOpD performance stays stable compared with supervised methods given limited access to annotated diseased data.

Paper & Code Let's connect?

