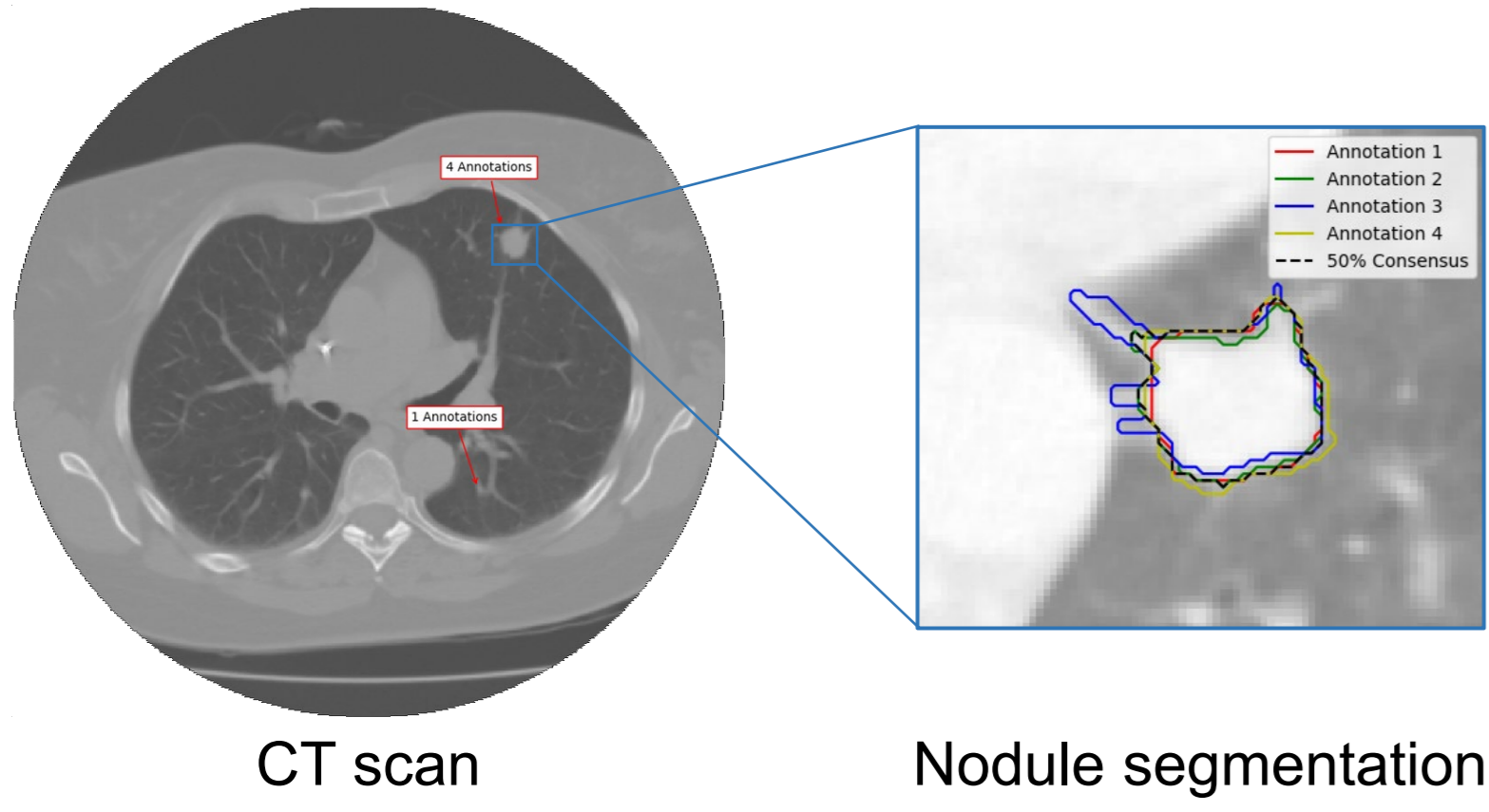## BACKGROUND

Effective lung cancer screening requires accurate characterisation of lung nodules in CT images. Post-hoc explainable approaches that attempt to interpret "black boxes" are not deemed trustworthy enough in clinical practice.


CT scan · Nodule segmentation · Annotation info

Nodule attributes	
Subtlety	Obvious
InternalStructure	Soft Tissue
Calcification	Non-central
Sphericity	Ovoid
Margin	Sharp
Lobulation	Nearly No Lobulation
Spiculation	Medium Spiculation
Texture	Solid
Malignancy	**Moderately Suspicious**

Self-explanatory methods

- 👍 Trained to use a set of human-understandable clinical concepts to explain and derive their decisions
- 👎 The additional annotation needs still limit the applicability of this approach

The learned semantically meaningful reasoning space
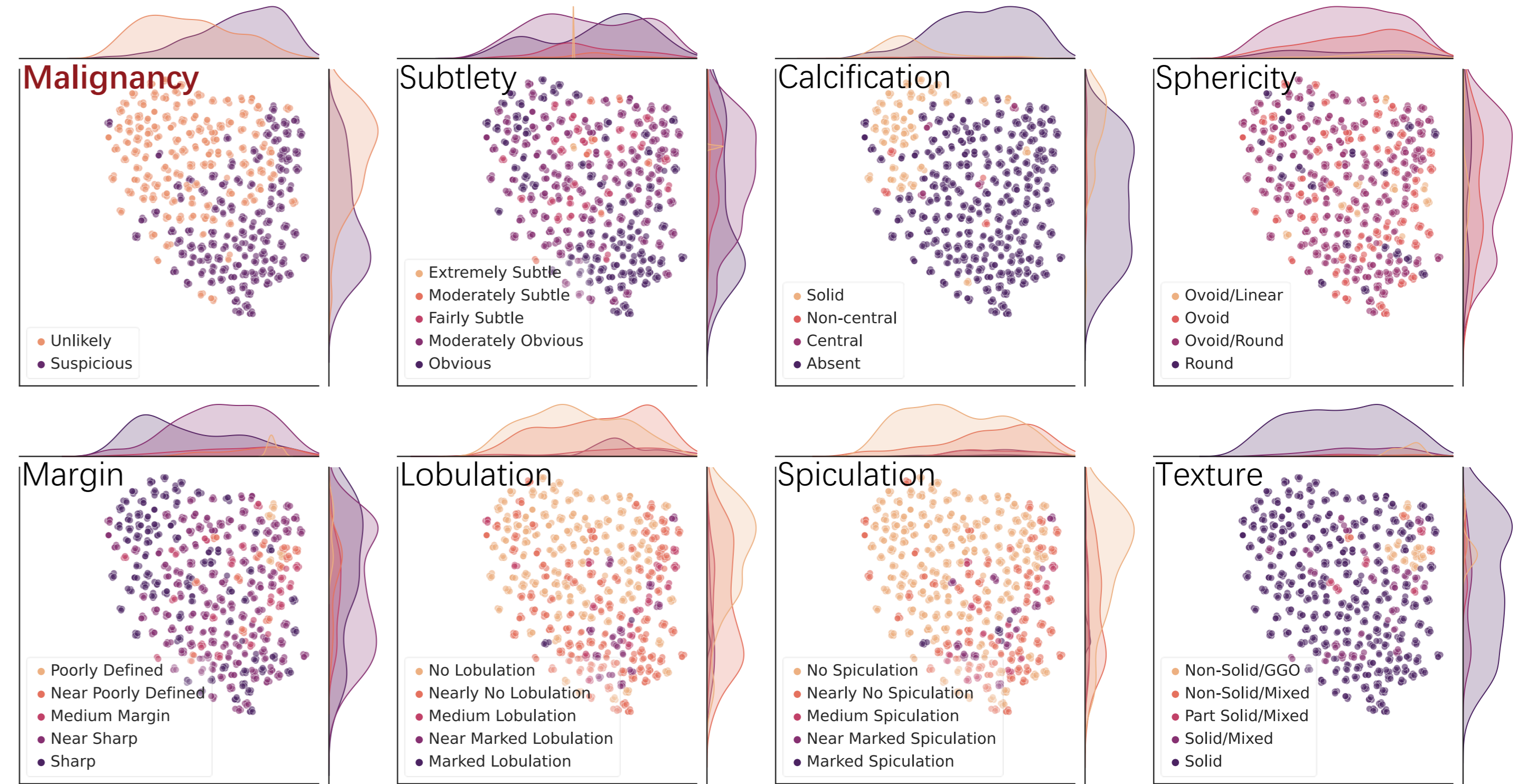
- Reasonable separability in both malignancy and nodule attributes
- Intuitive correlation between nodule attributes and malignancy

Self-explanatory lung nodule diagnosis can be more trustworthy, even with 99% annotation reduced.

cRedAnno+: Annotation Exploitation in Self-Explanatory Lung Nodule Diagnosis

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github.com/diku-dk/credanno
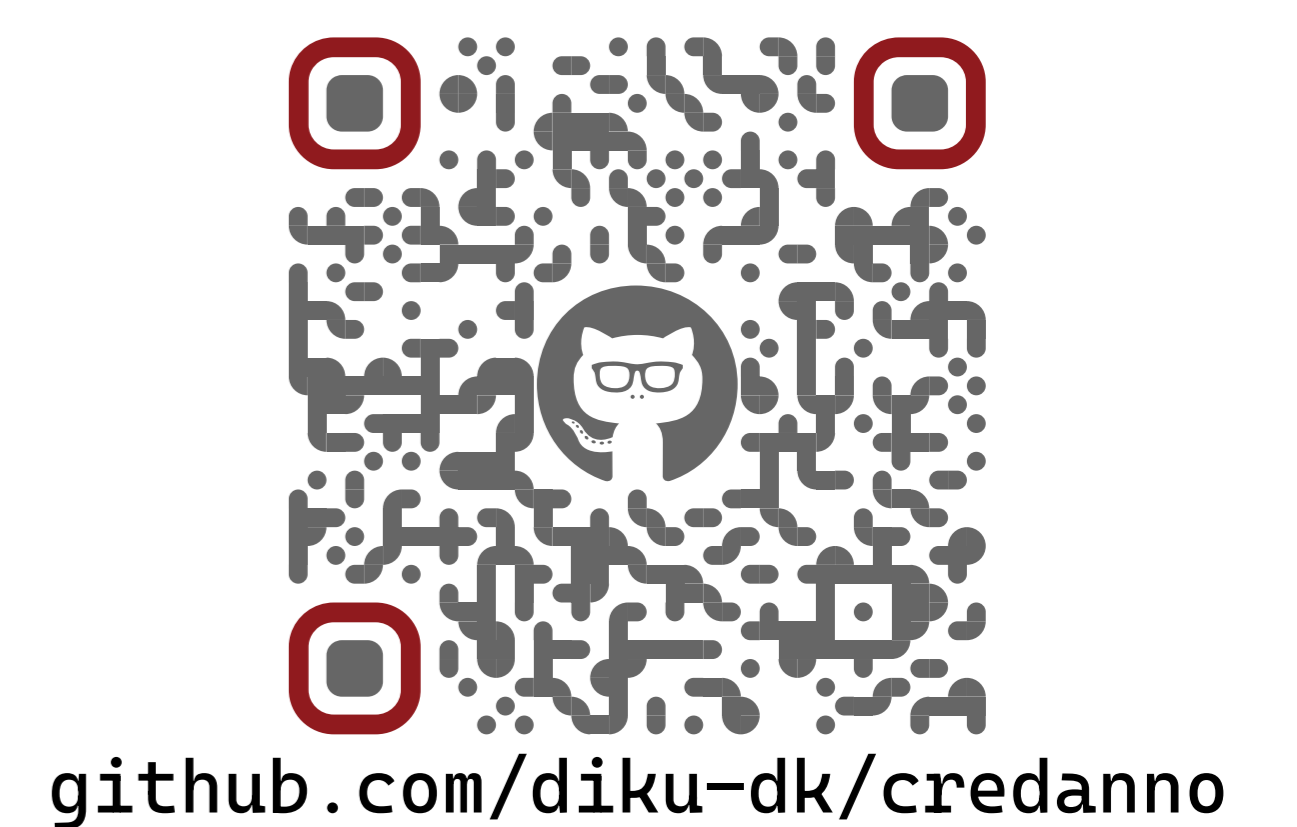
METHOD

Aim: to jointly utilise the extracted features, annotations, and unlabelled data
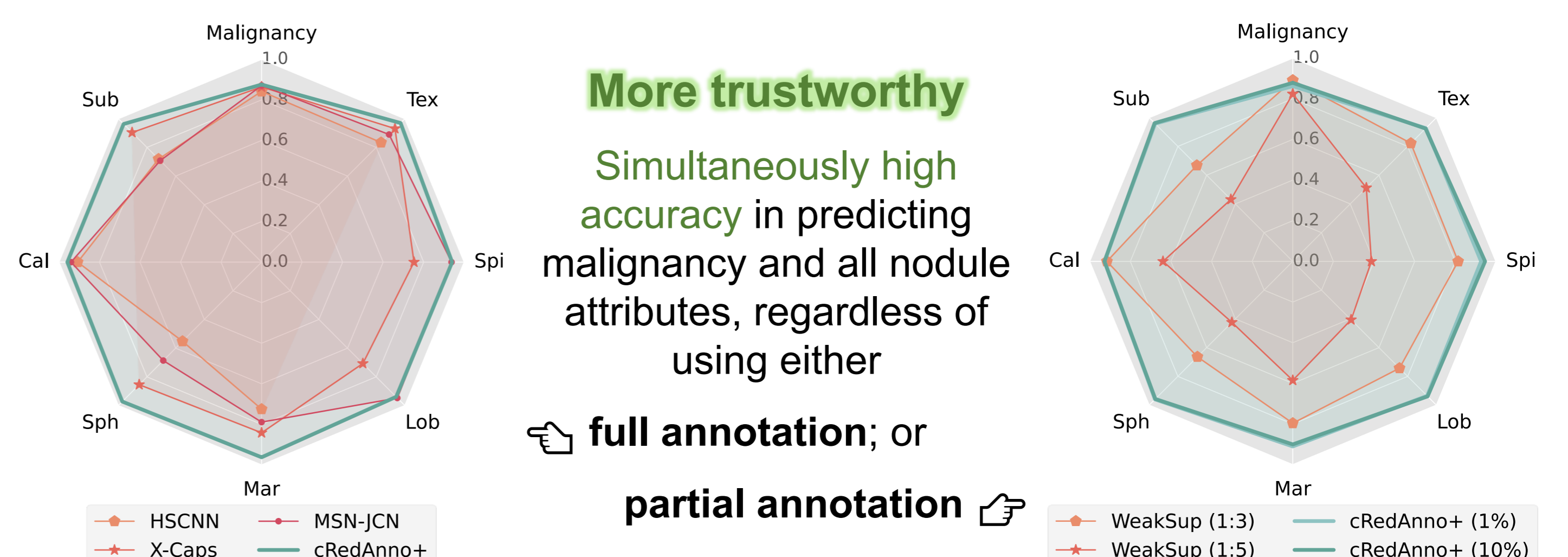
Annotation exploitation mechanism:
- Sparse seeding: cluster centroids
- Semi-supervised active learning: uncertainty sampling & pseudo labelling
- Quenching: update pseudo labels & reinitialise the weights
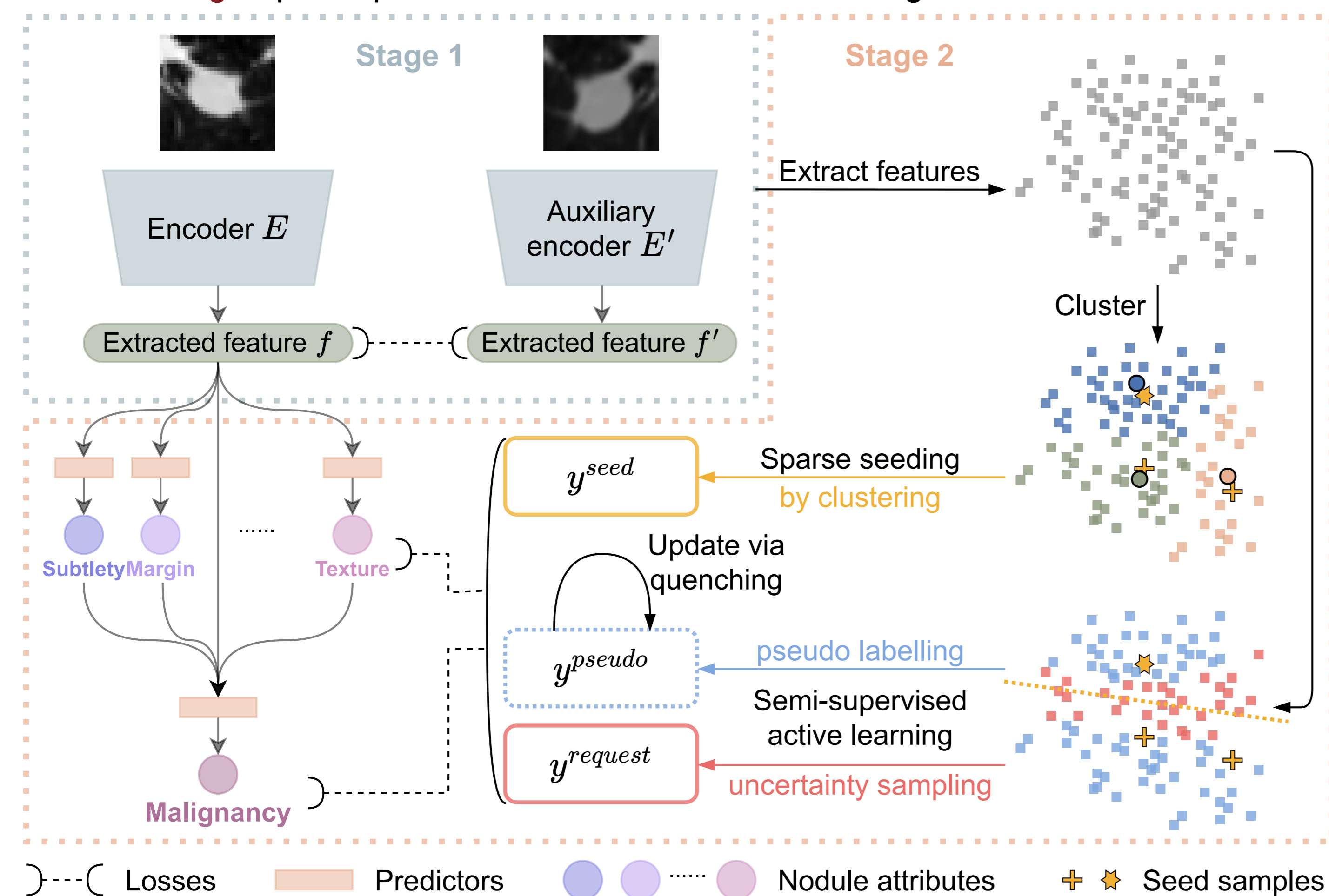
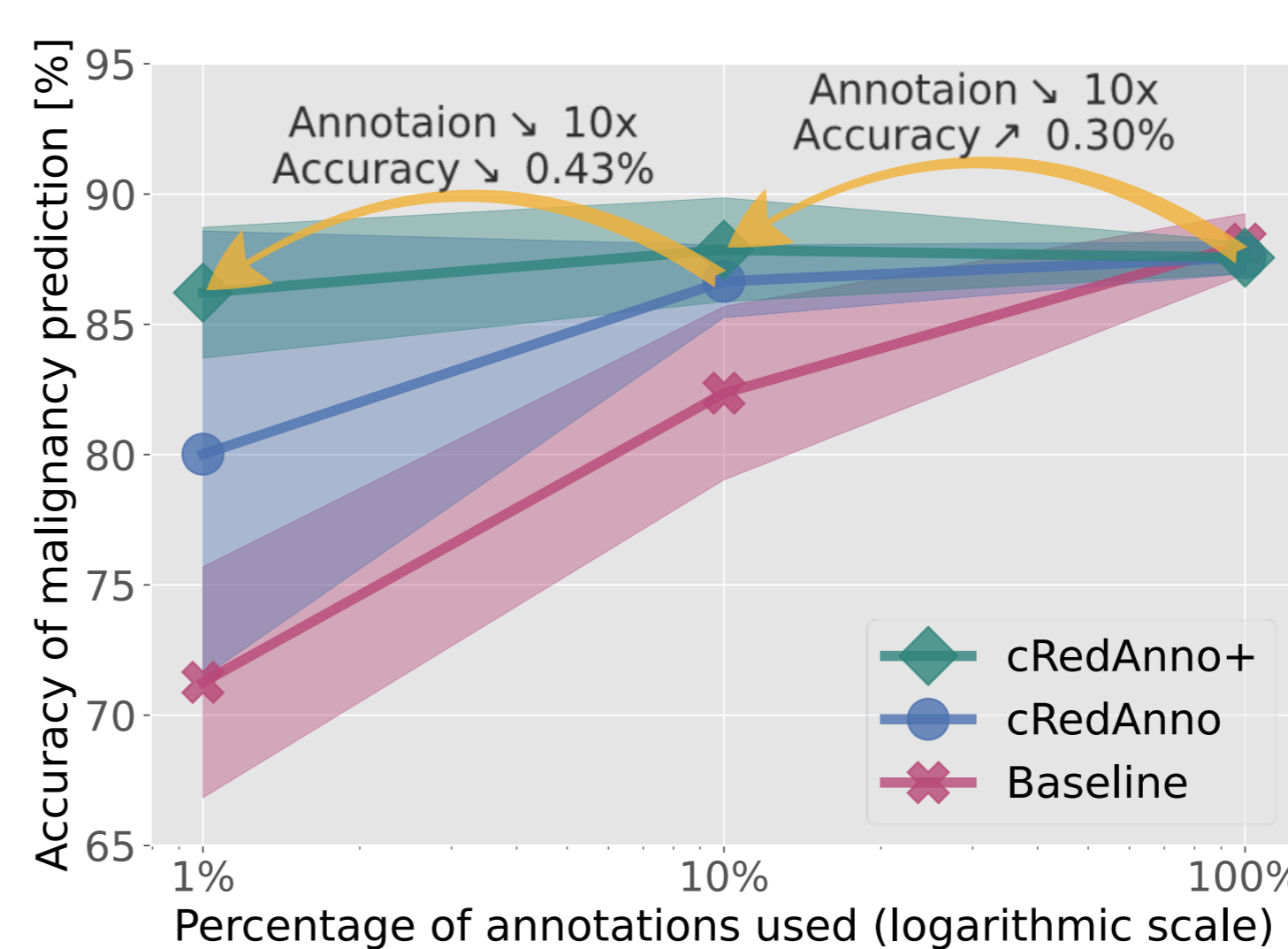
RESULTS

Performance of explanation and prediction

More trustworthy

Simultaneously high accuracy in predicting malignancy and all nodule attributes, regardless of using either

👉 full annotation; or

partial annotation 👉

Compared with our previous method:

More annotation-efficient
- Comparable or even higher accuracy of malignancy prediction with 10x fewer annotation

More robust
- Better robustness under the condition of 1% annotation.