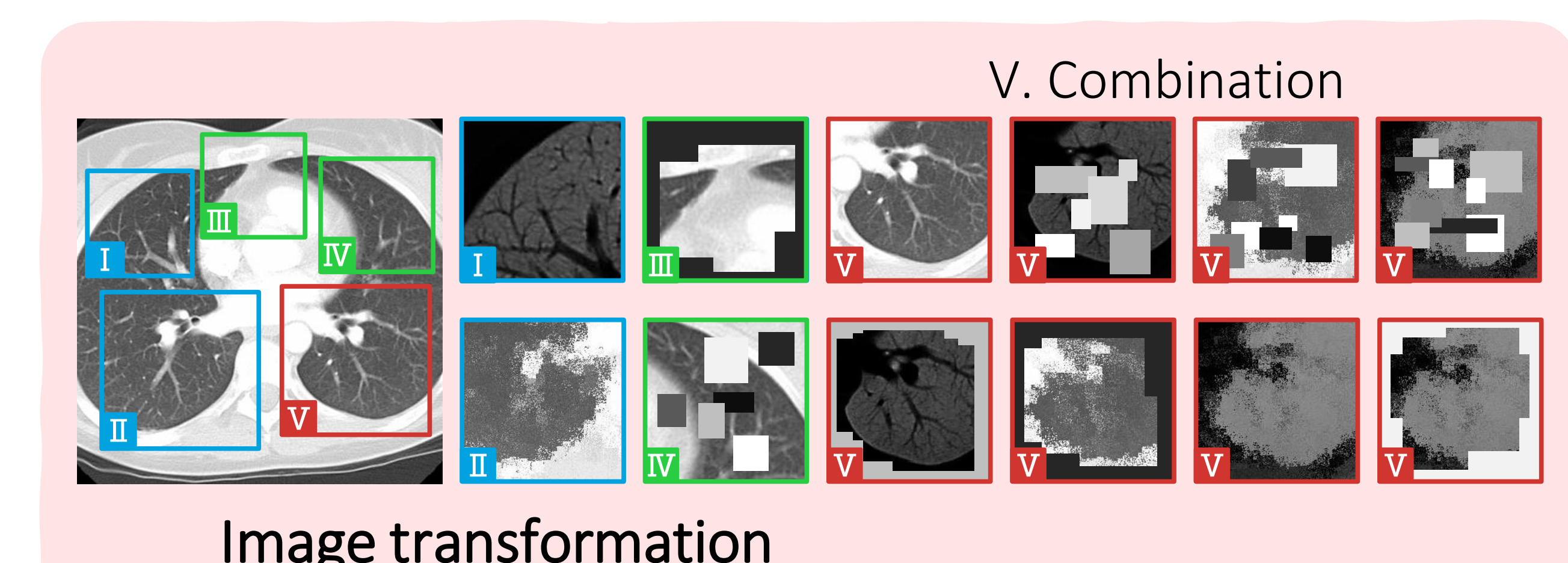
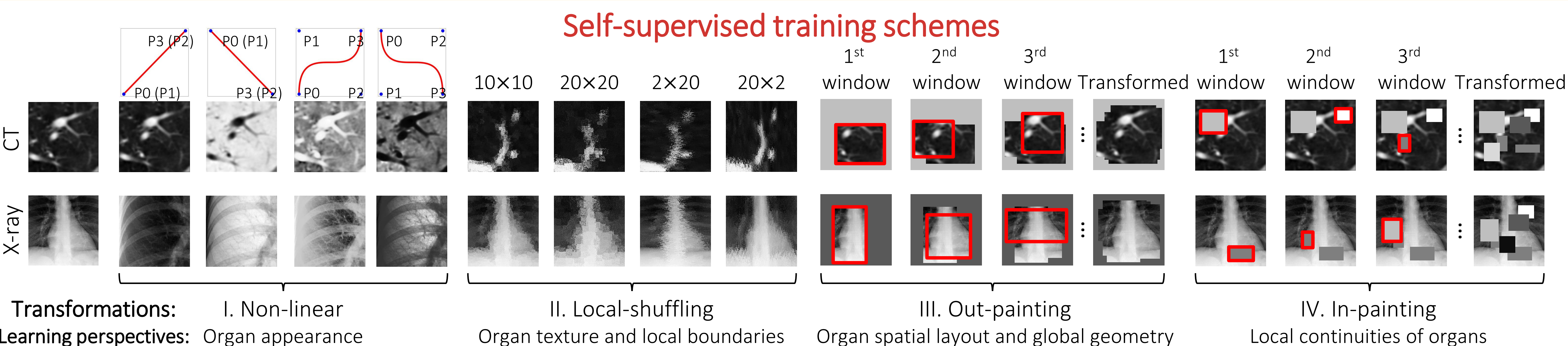


We provide pre-trained 3D models for 3D medical image analysis

Background: Transfer learning from *natural* images to *medical* images has established as one of the most practical paradigms in deep learning for medical image analysis. However, to fit this paradigm, 3D imaging tasks in the most prominent imaging modalities (e.g., CT and MRI) have to be reformulated and solved in 2D, losing rich 3D anatomical information and inevitably compromising the performance. **Pre-trained 3D models have yet to emerge for 3D medical imaging.**

Contribution: A collection of pre-trained **3D generic source models**, called **Generic Autodidactic Models**, nicknamed **Models Genesis**. They are built directly from **unlabeled** 3D image data with **our novel self-supervised learning method**, for **generating powerful application-specific target models through transfer learning**.

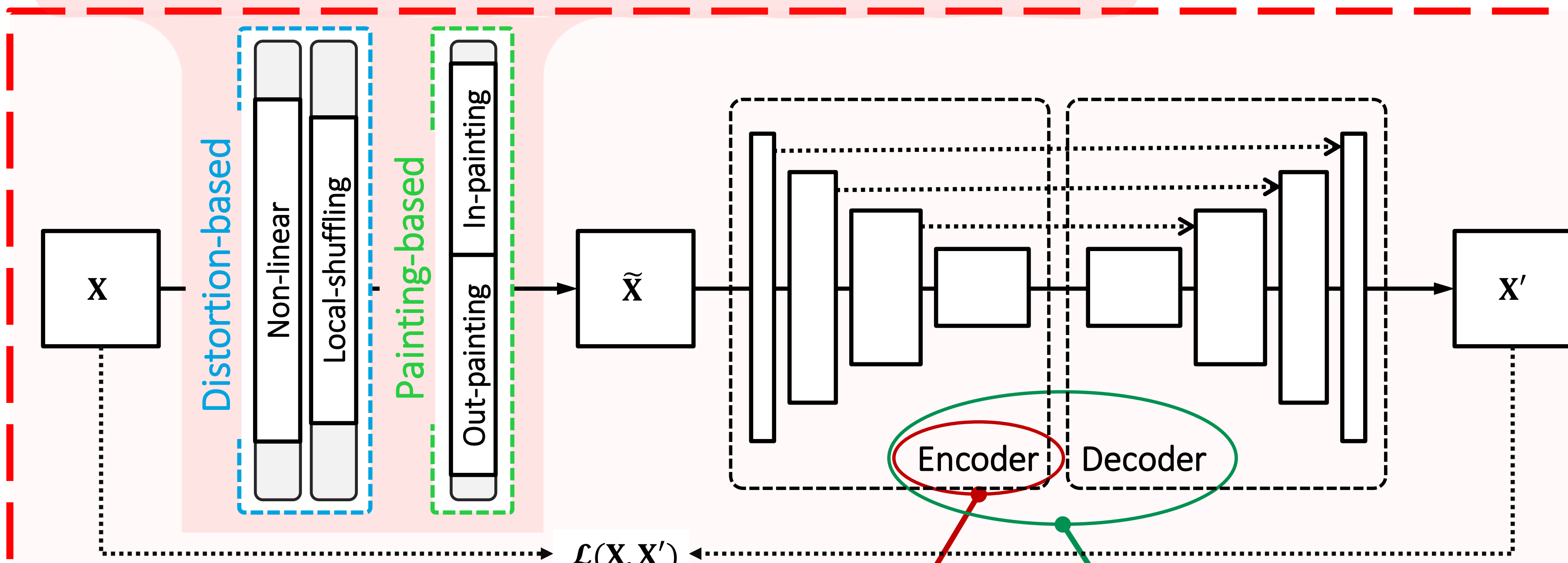
Vision: Through **open science**, we envision that Models Genesis may serve as a primary resource in transfer learning for 3D medical imaging, in particular, with limited annotation, and hope that such collaborative efforts will lead to the **Holy Grail of Models Genesis, effective across diseases, organs, and modalities**.



Ablation study: Learning from multiple perspectives leads to robust models

Task	Scratch (%)	I & II (%)	III & IV (%)	V (%)	p-value
Lung nodule false positive reduction	94.25±5.07	96.46±1.03	98.20±0.51	97.90±0.57	0.0848
Lung nodule segmentation	74.05±1.97	77.08±0.68	77.02±0.58	77.62±0.64	0.0520
PE false positive reduction	79.99±8.06	88.04±1.40	87.18±2.72	87.20±2.87	0.2102
Liver segmentation	74.60±4.57	79.08±4.26	78.62±4.05	79.52±4.77	0.4249
Brain tumor segmentation	90.16±0.41	90.60±0.20	90.46±0.21	90.59±0.21	0.4276

The statistical analyses are conducted between the top-2 models in each row highlighted in red.



Properties of Models Genesis:

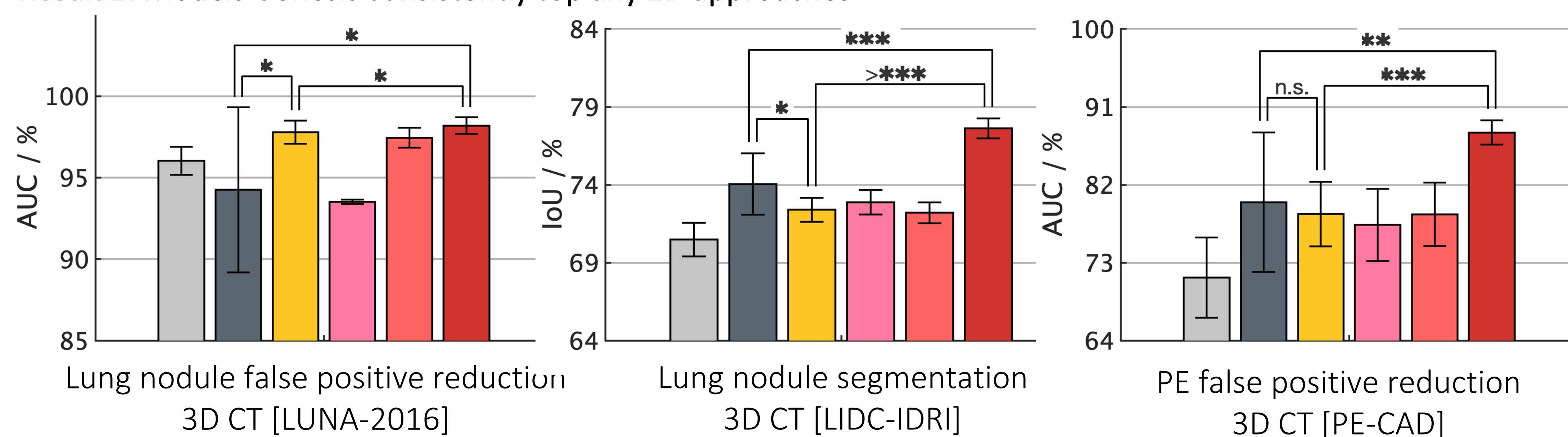
- Autodidactic—requiring no manual labeling
- Robust—learning from multiple perspectives
- Scalable—eliminating proxy-task-specific heads
- Generic—yielding diverse applications

Result 1: Models Genesis outperform 3D models trained from scratch

Task	Modality	Metric	Scratch (%)	Genesis (%)	p-value
Lung nodule false positive reduction	CT	AUC	94.25±5.07	98.20±0.51	0.0180
Lung nodule segmentation	CT	IoU	74.05±1.97	77.62±0.64	1.04e-4
PE false positive reduction	CT	AUC	79.99±8.06	88.04±1.40	0.0058
Liver segmentation	CT	IoU	74.60±4.57	79.52±4.77	0.0361
Brain tumor segmentation	MRI	IoU	90.16±0.41	90.60±0.20	0.0041

The statistical analyses are conducted between Scratch and Genesis.

Result 2: Models Genesis consistently top any 2D approaches



Result 3: Models Genesis (2D) offer performances equivalent to supervised pre-trained models

