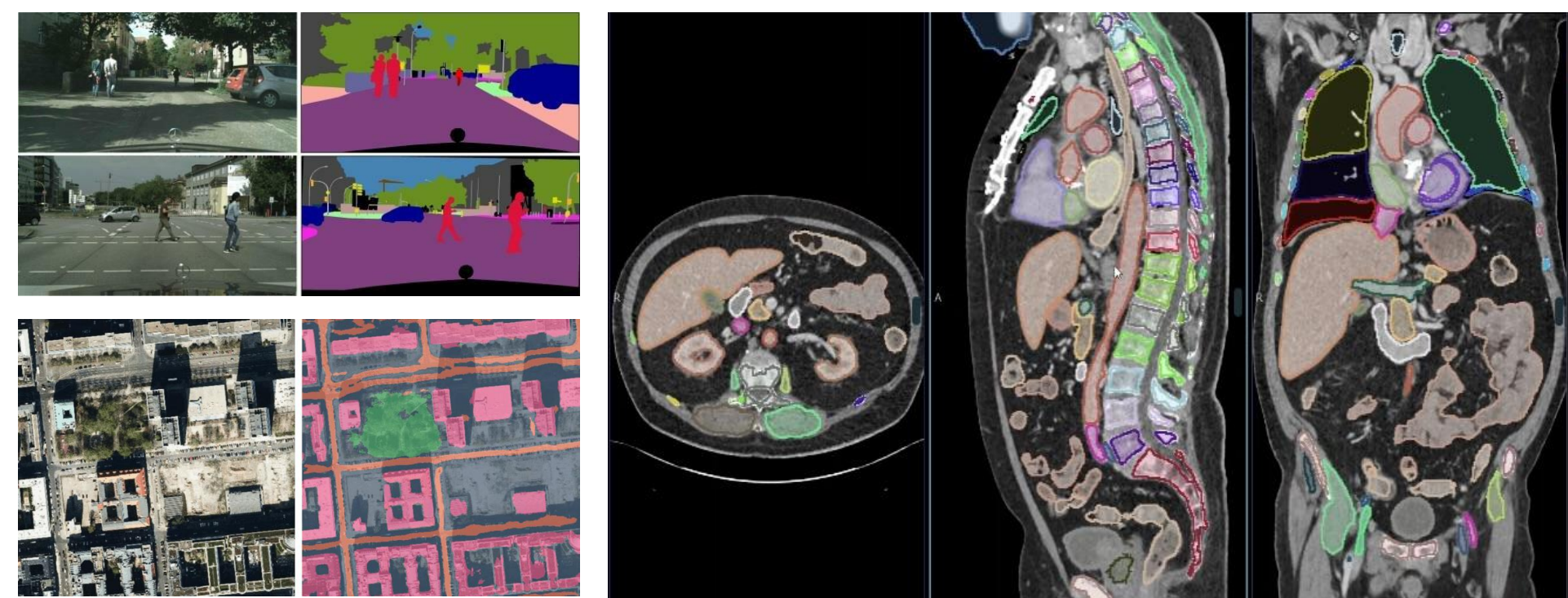


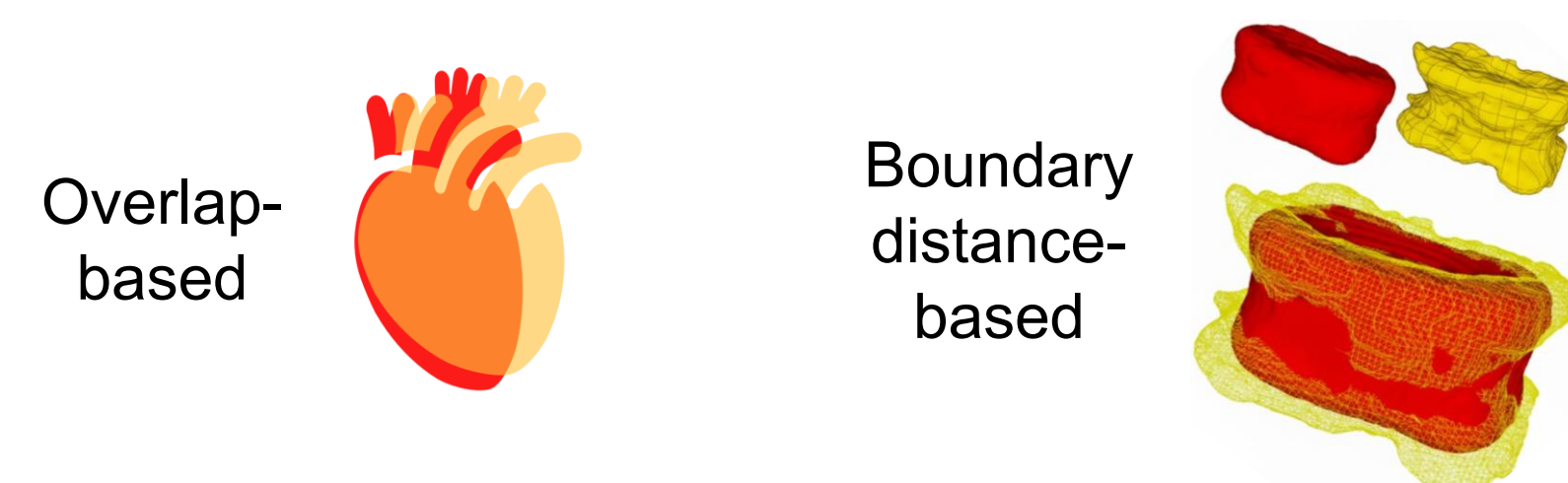
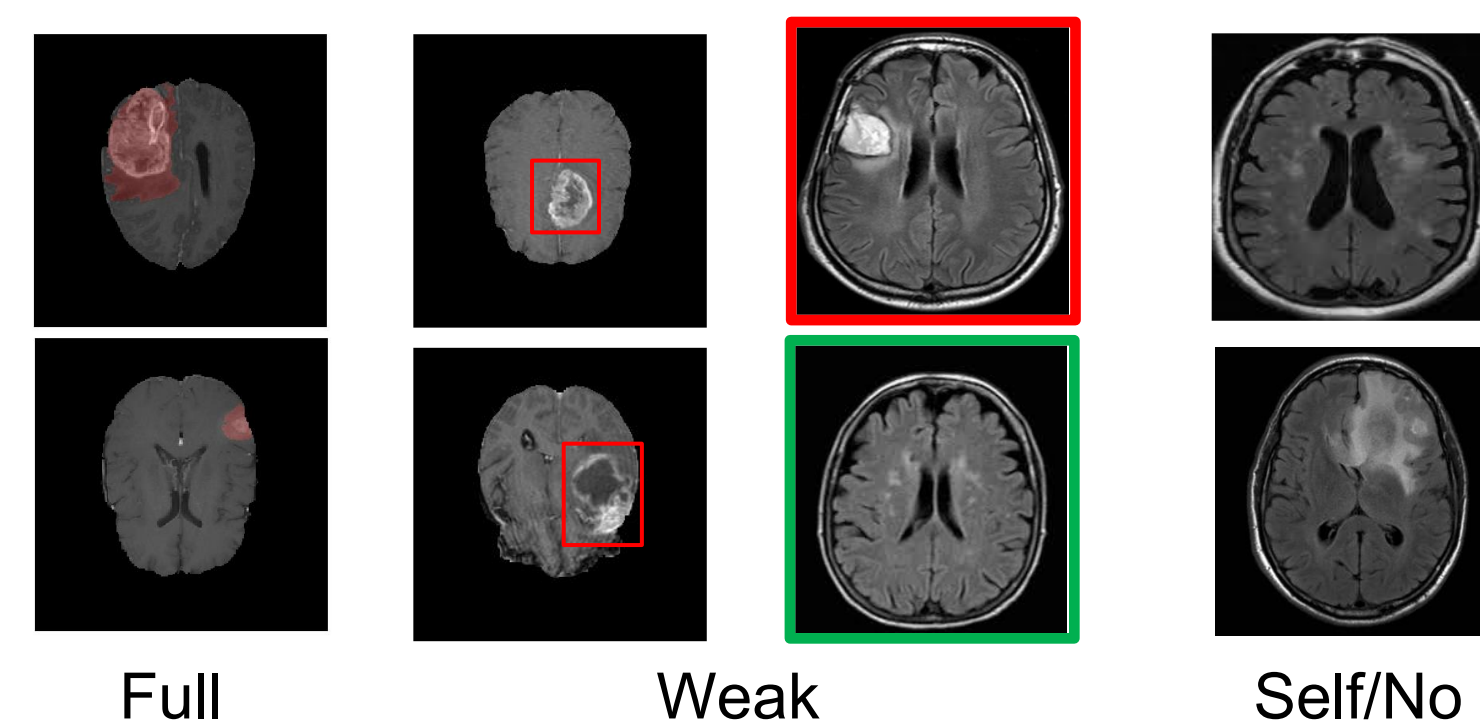
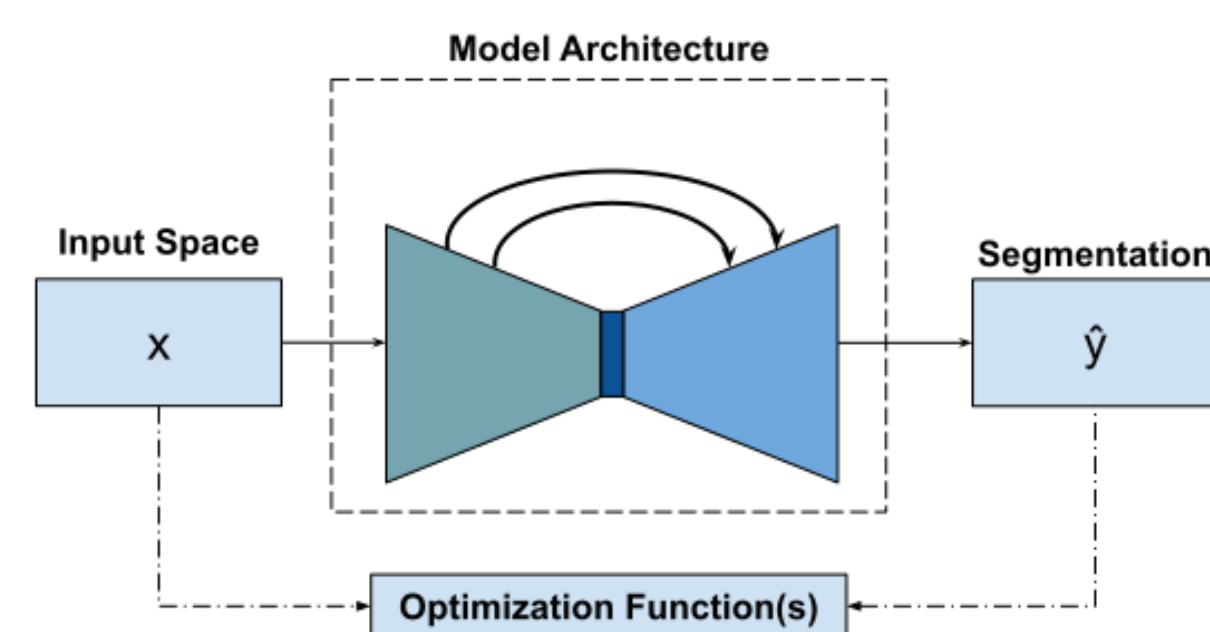
## IMAGE SEGMENTATION

Partitioning an image into multiple segments or regions, such that, given an image  $I$ , each pixel/voxel  $v_i$  is assigned a label  $L_i$ .


 Deep Learning for  
Image Segmentation

 Supervision  
Levels

Evaluation



## CONTRIBUTION

Survey of **250+ papers** on deep learning-based semantic segmentation of natural & medical images.

- Springer AI Review journal (2024 IF: 13.9).
- 1000+ citations (October 2025).



## KEY OBSERVATIONS

### Architecture

- U-Net-like **encoder-decoder** models & skip connections.
- Attention** mechanisms.
- Multi-scale** representations.

### Loss

- (Soft) **Dice Loss**.
- Uncertainty-aware** losses.
- Hybrid** combinations of loss functions.

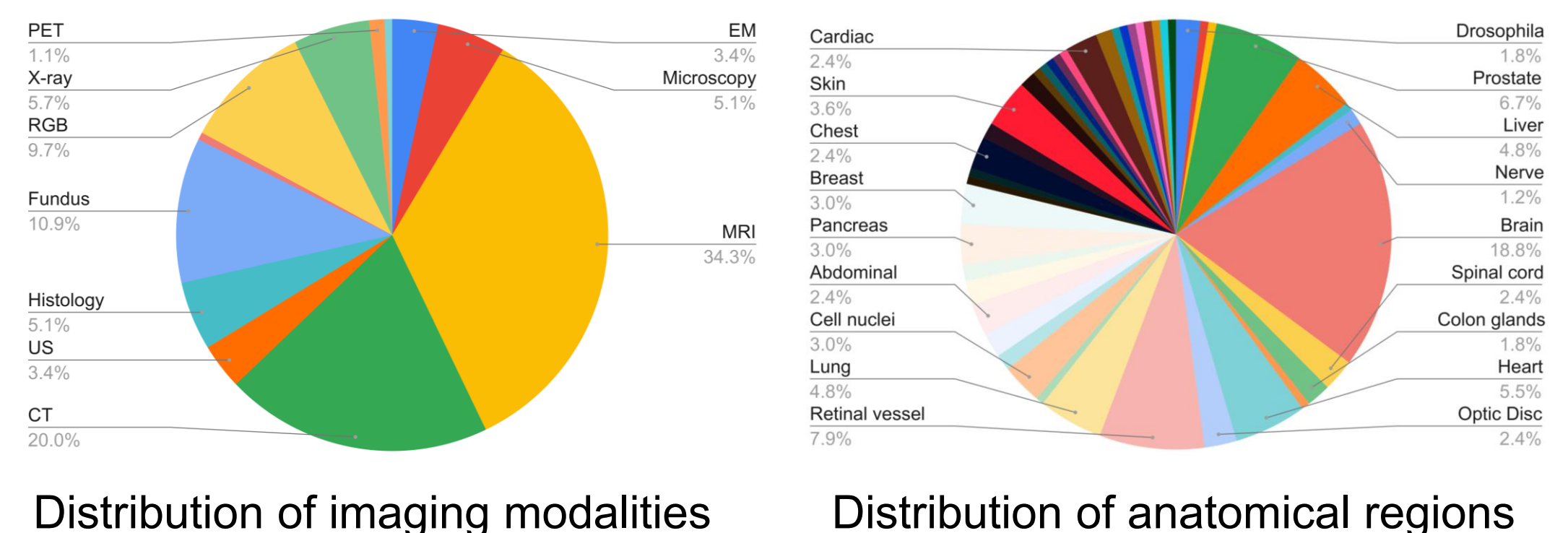
### Training

- Synthesis-based** augmentation.
- Weak** supervision.
- Multi-task** learning paradigms.

### Domain-specific

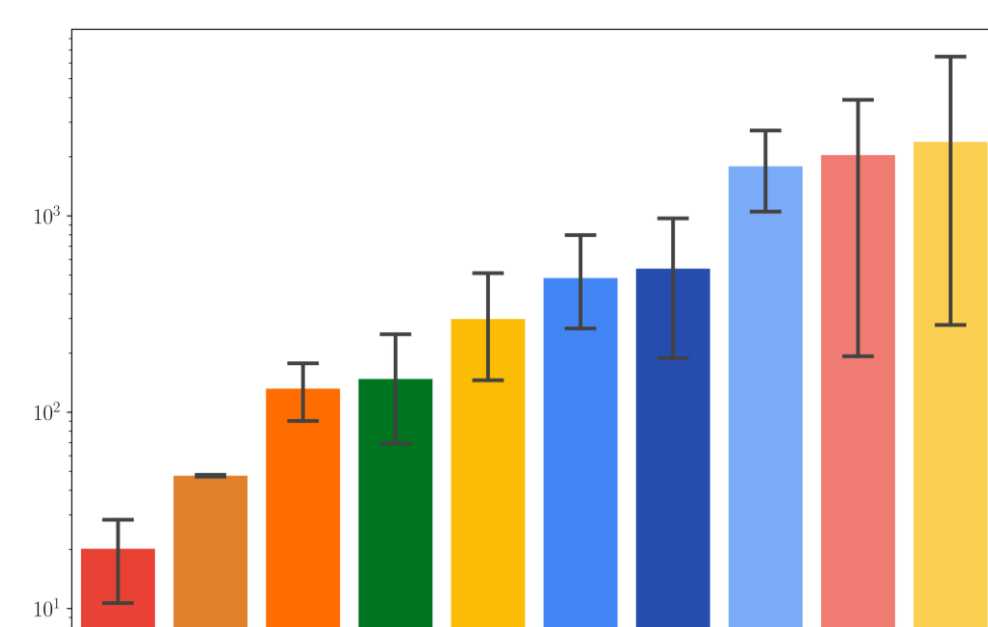
- Integrating **clinical priors**.
- 3D** volumetric segmentation.
- Public challenges**-driven progress.

## MEDICAL IMAGE SEGMENTATION: TRENDS IN RESEARCH AND COMPETITIONS

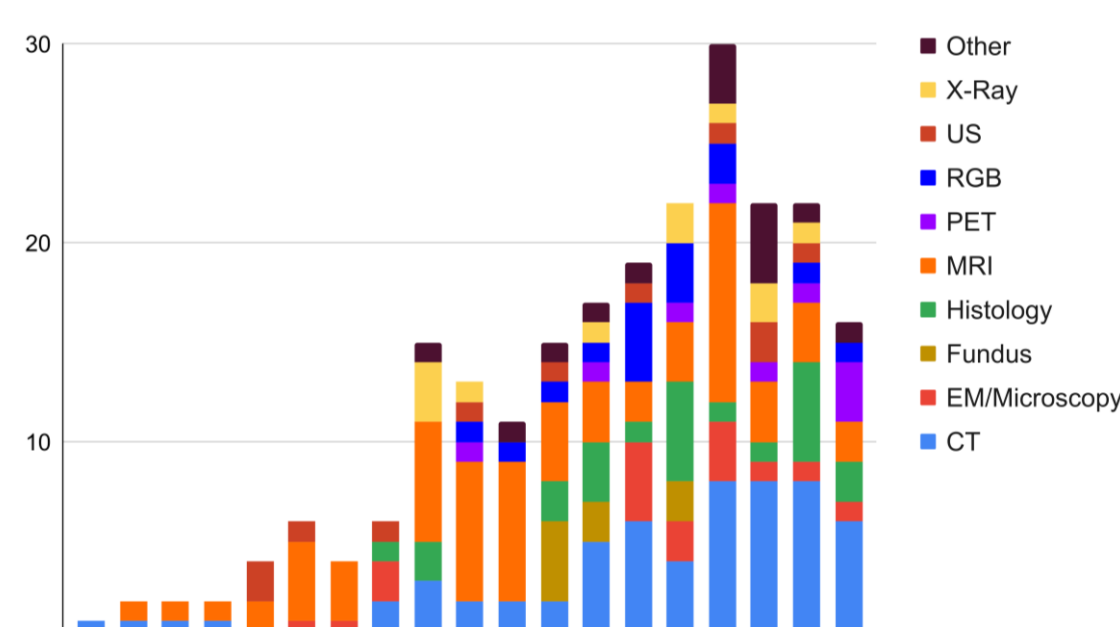


Distribution of imaging modalities

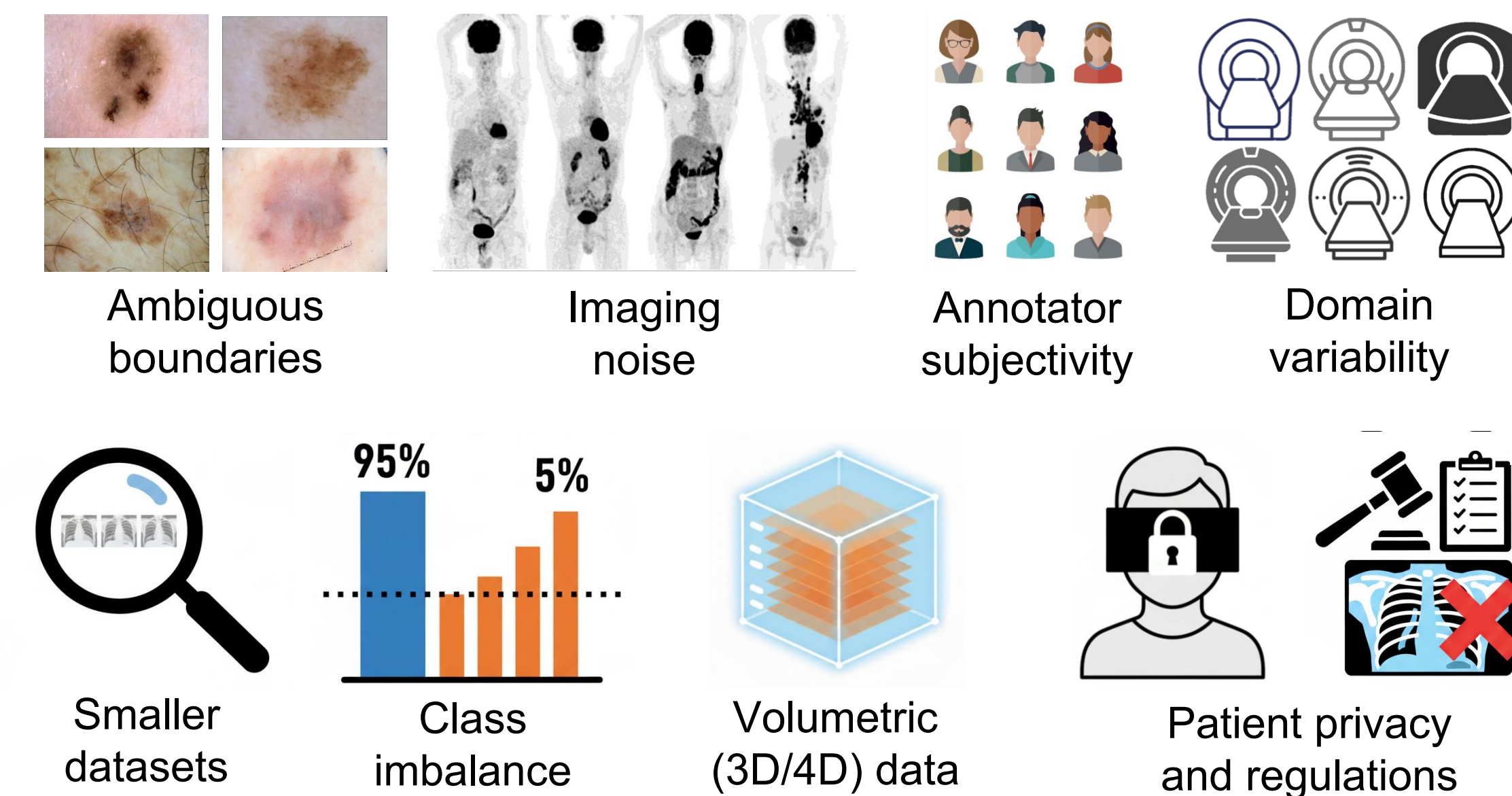
Distribution of anatomical regions



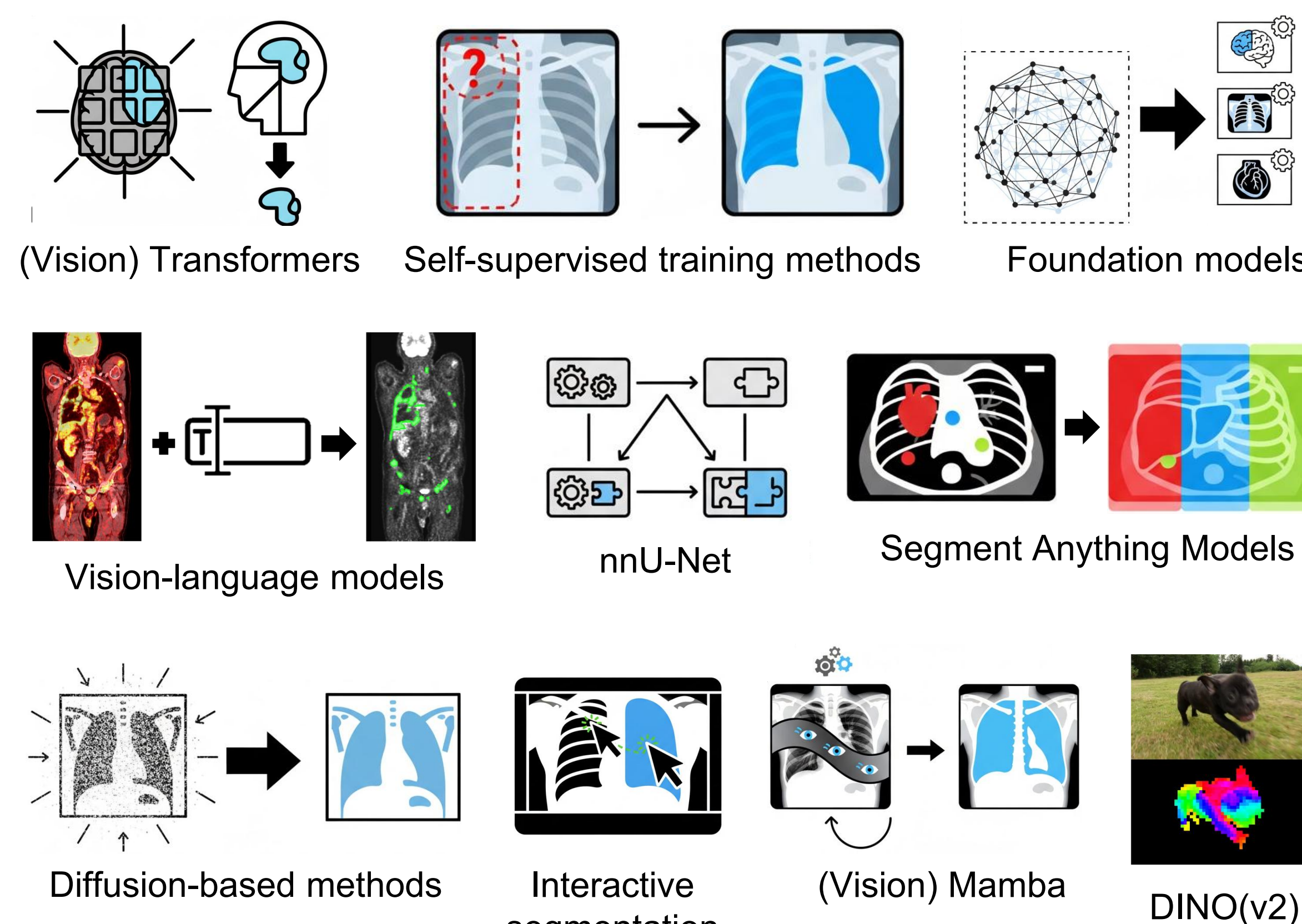
Dataset sizes across modalities


 Modalities in competitions  
(<https://grand-challenge.org/>)

## WHY IS MEDICAL IMAGE SEGMENTATION HARD?



## RECENT ADVANCES SINCE THIS REVIEW



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