

# Decoupled Semantic Prototypes enable learning from diverse annotation types for semi-weakly segmentation in expert-driven domains

Poster Session WED-PM-299



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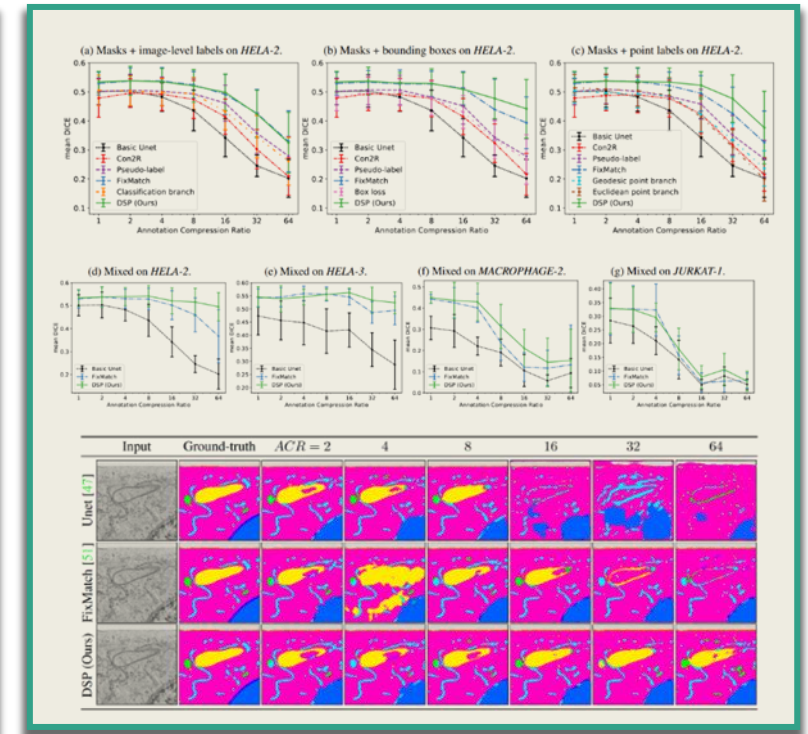
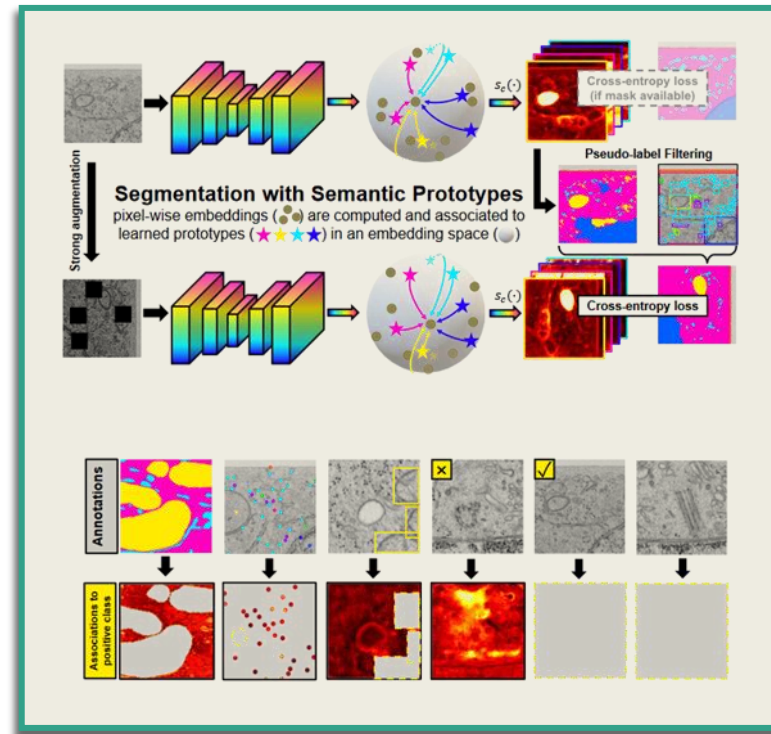
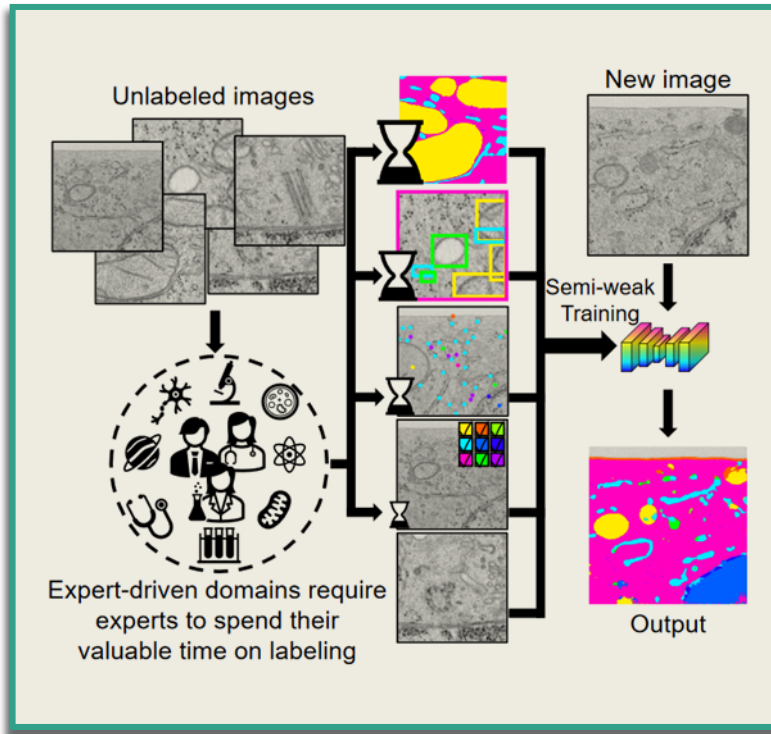
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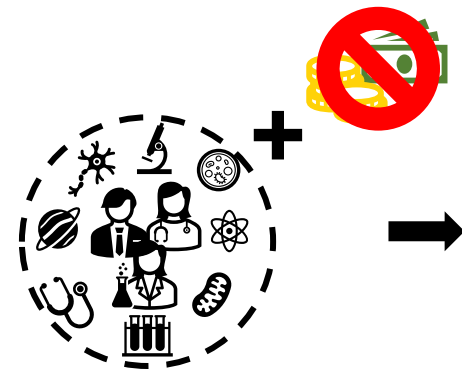
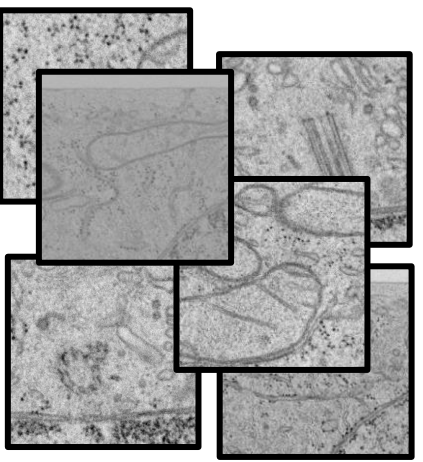
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Challenge: Expert availability

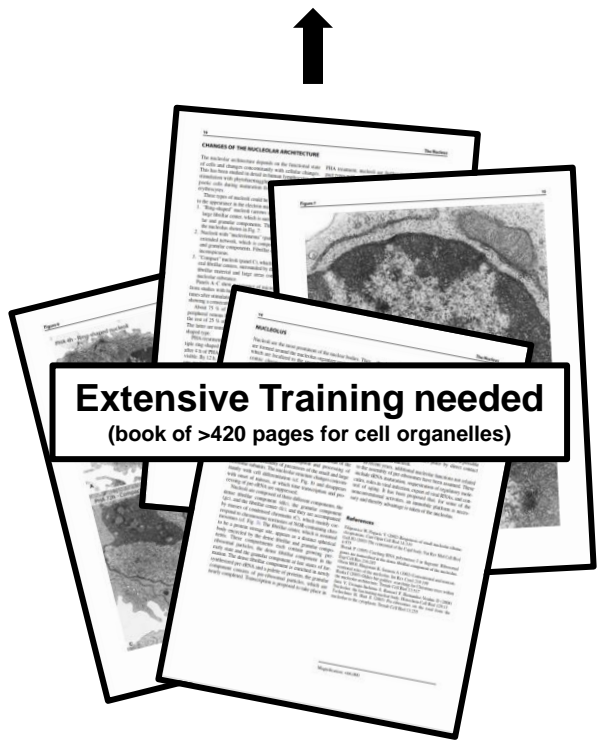
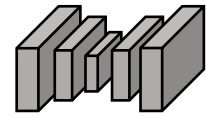
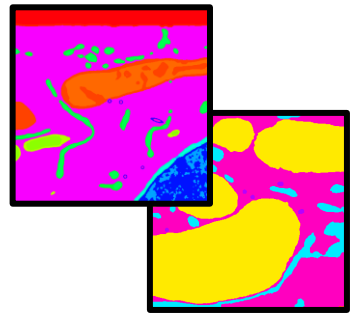
Our solution

Results



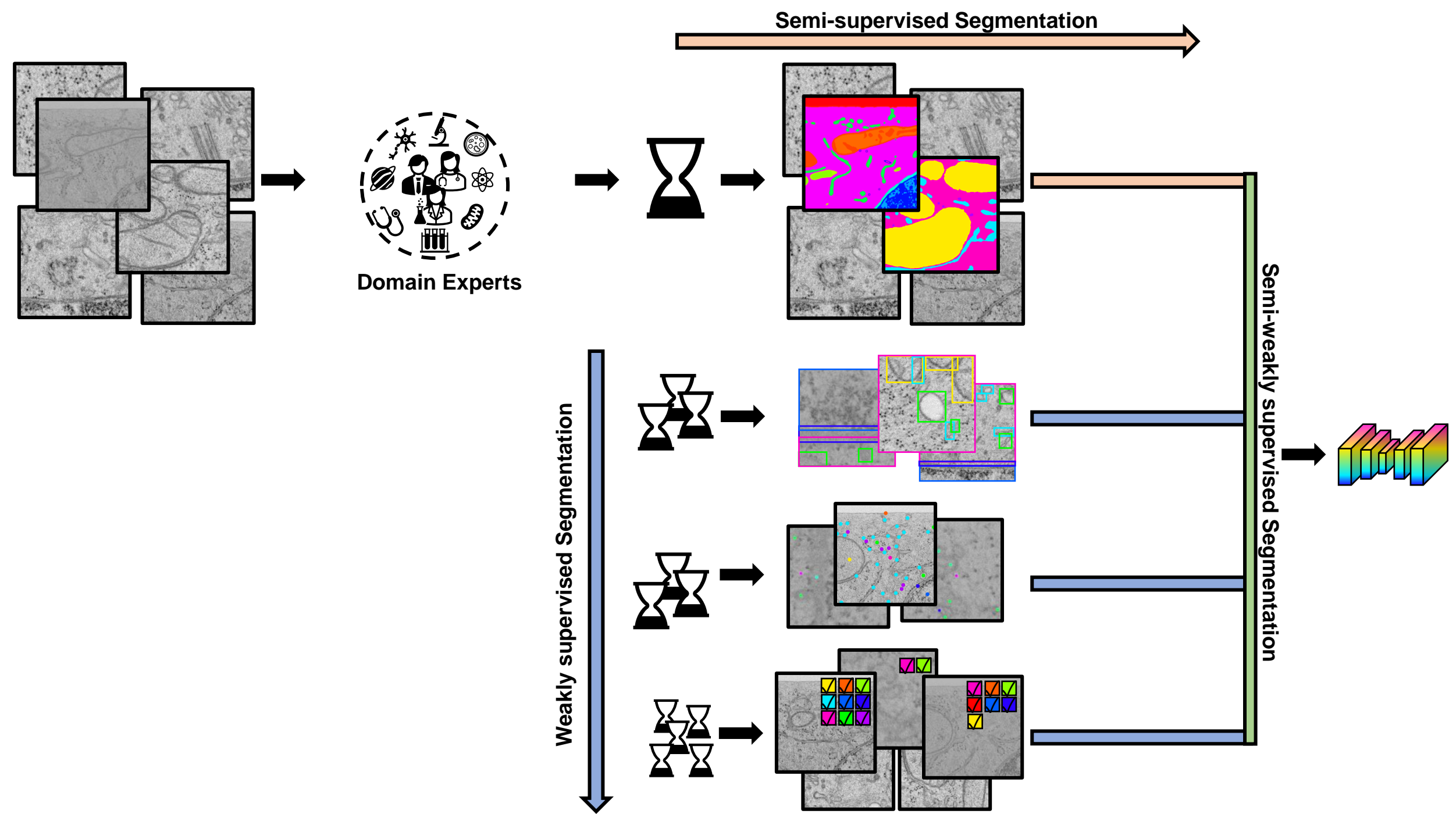


Domain Experts

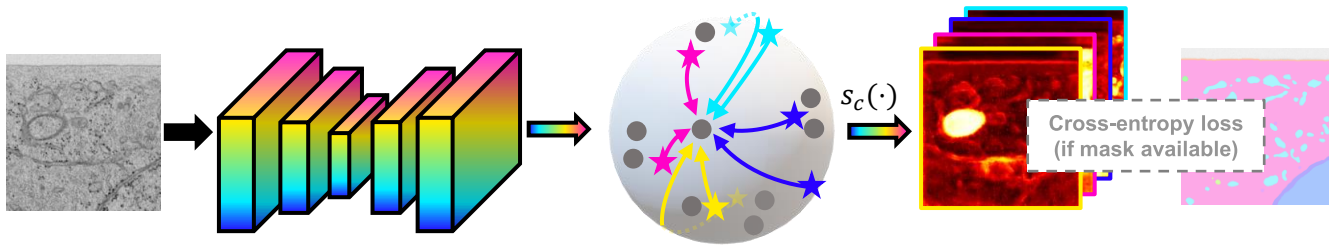


**Extensive Training needed**  
(book of >420 pages for cell organelles)





# Training with diverse annotation types



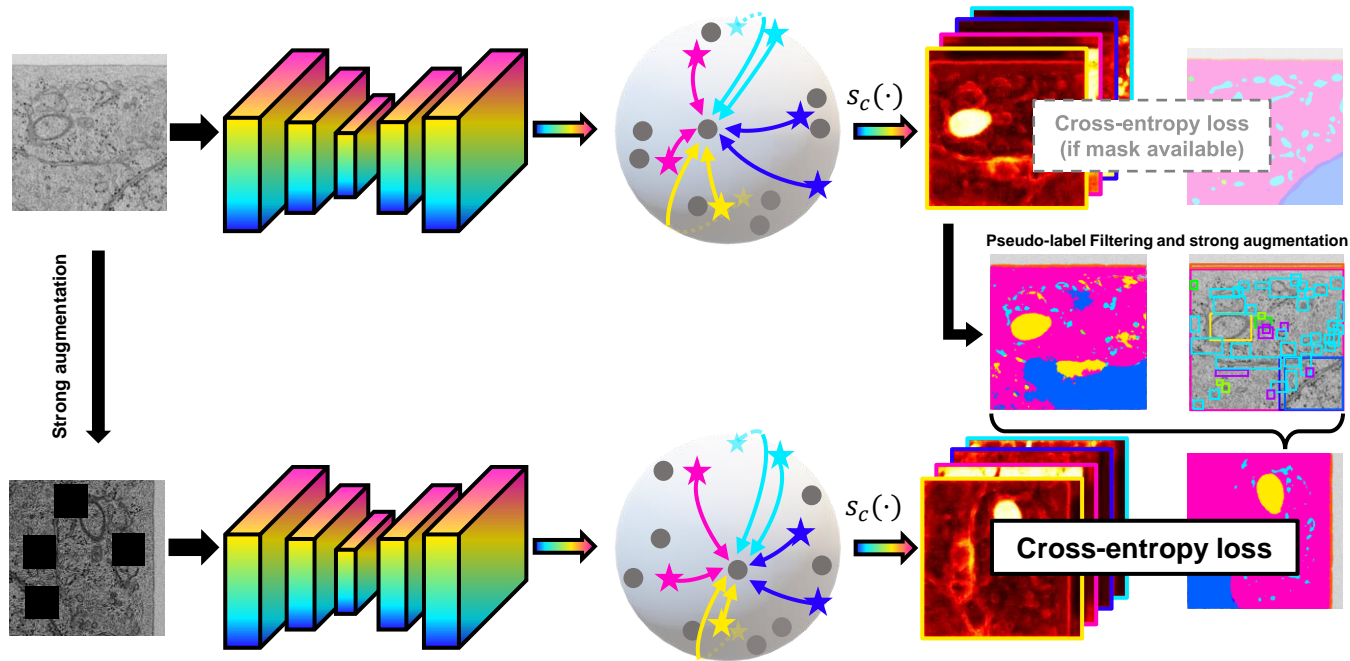
Pixel-embedding-prototype similarity

$$\sigma(f, p_c^j) = \frac{f^\top p_c^j}{\|f\| \cdot \|p_c^j\|}$$

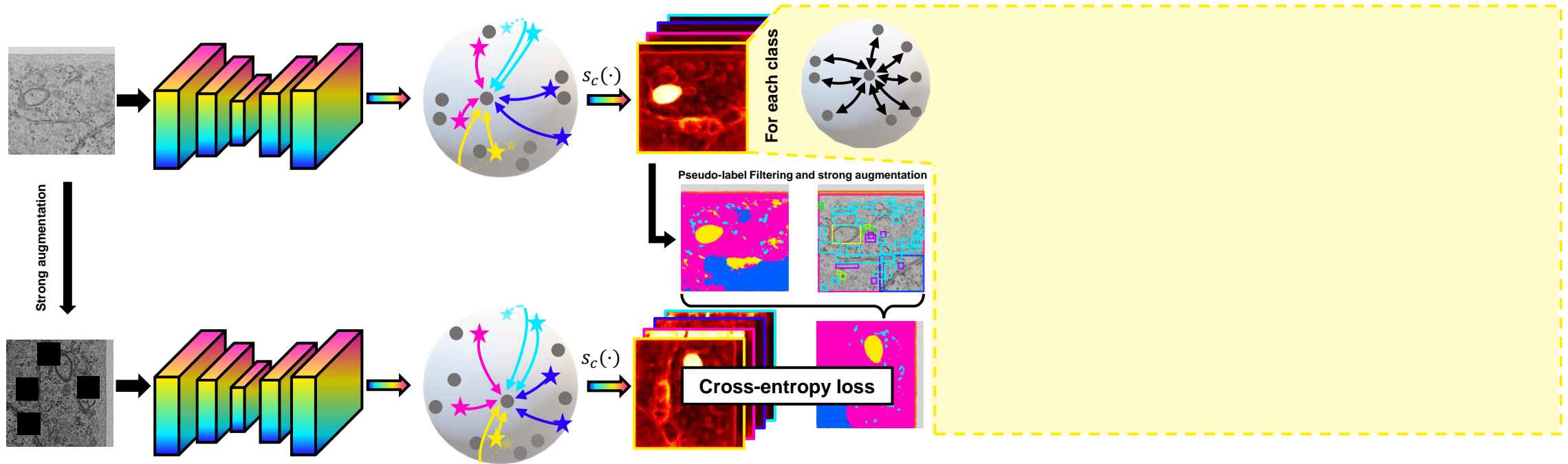
Class-wise score for pixel-embedding

$$s_c(f, P_c) = \frac{1}{|P_c|} \cdot \sum_{j \in P_c} \sigma(f, p_c^j)$$

# Training with diverse annotation types

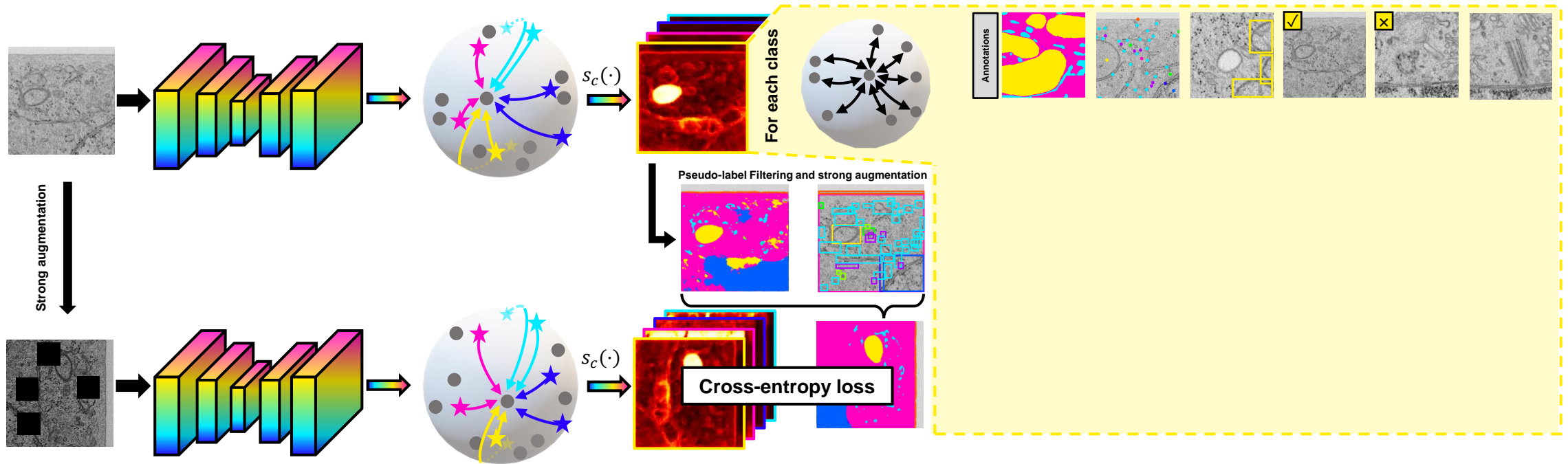


# Training with diverse annotation types



$$L(f_i, c) = -\log \frac{\exp(f_i \cdot c)}{\sum_j \exp(f_i \cdot c_j)}$$

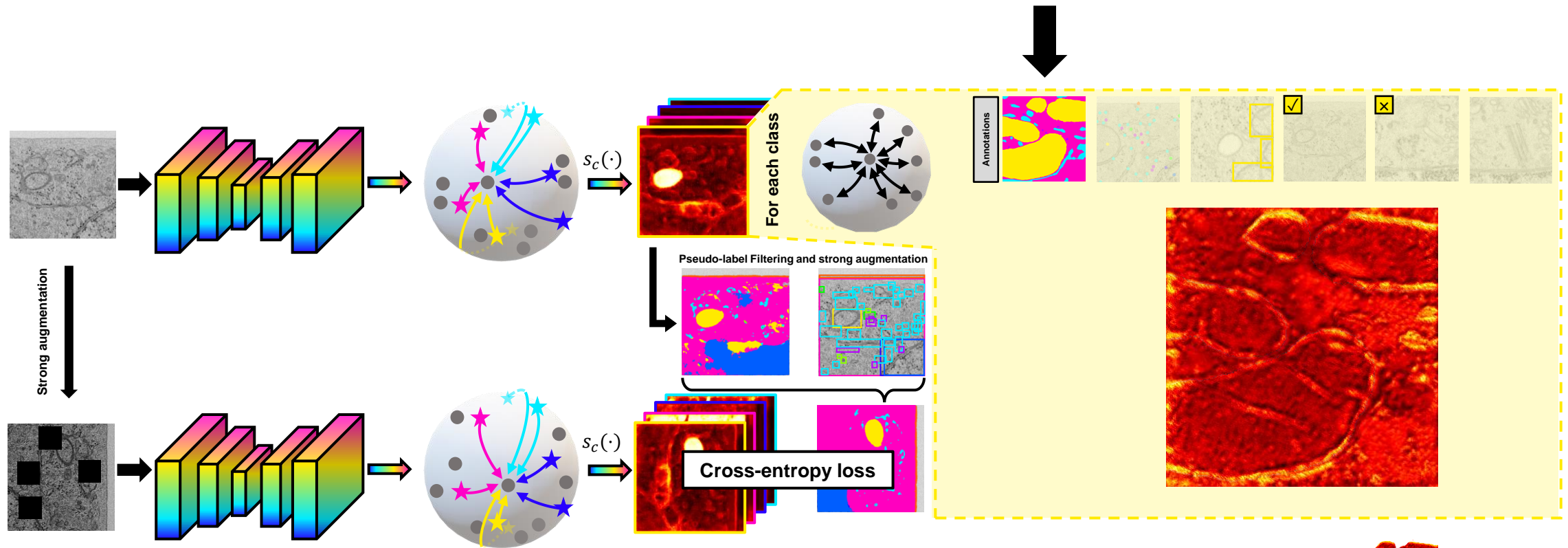
# Training with diverse annotation types



$$L(f_i, c) = -\log \frac{\exp(f_i \cdot c)}{\sum_j \exp(f_i \cdot c_j)}$$

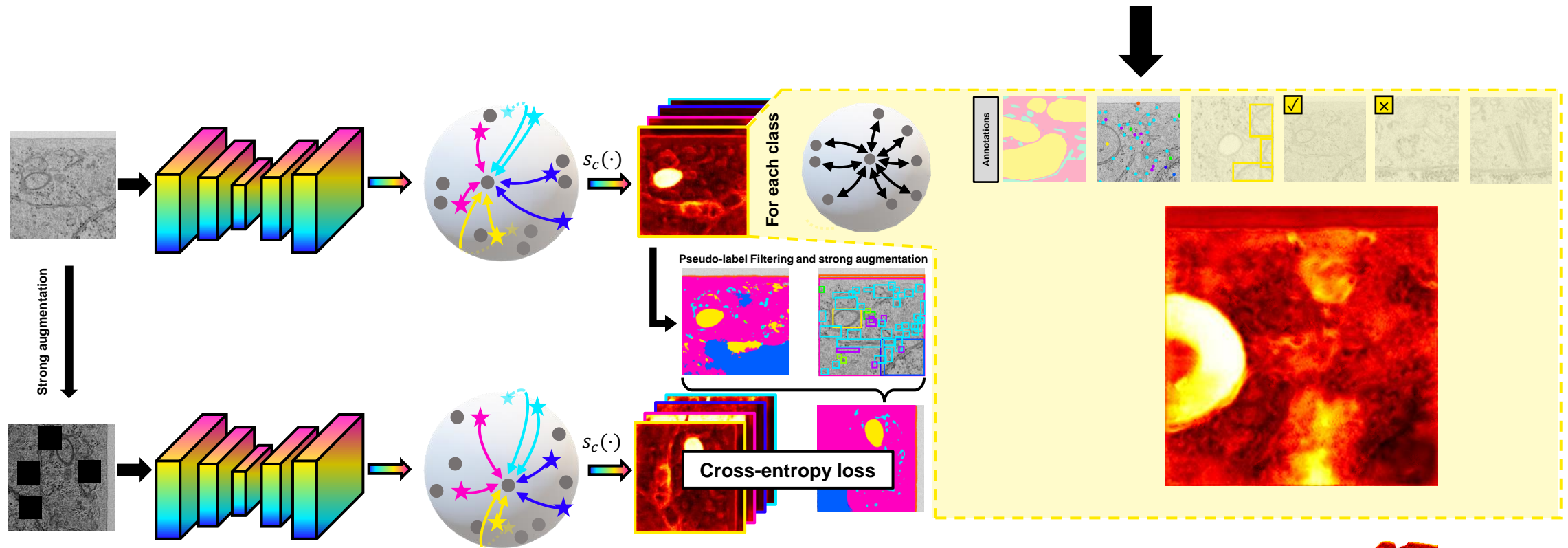


# Training with diverse annotation types



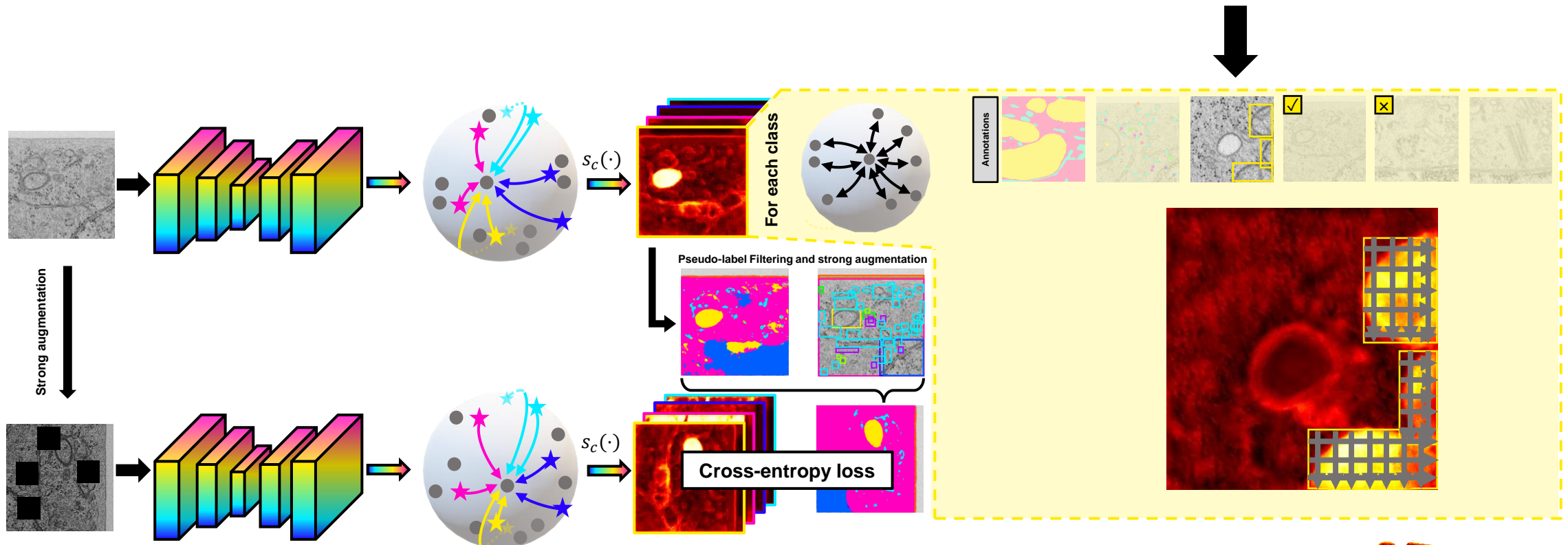
$$L(f_i, c) = -\log \frac{\text{Heatmap}}{\text{Annotations}}$$

# Training with diverse annotation types



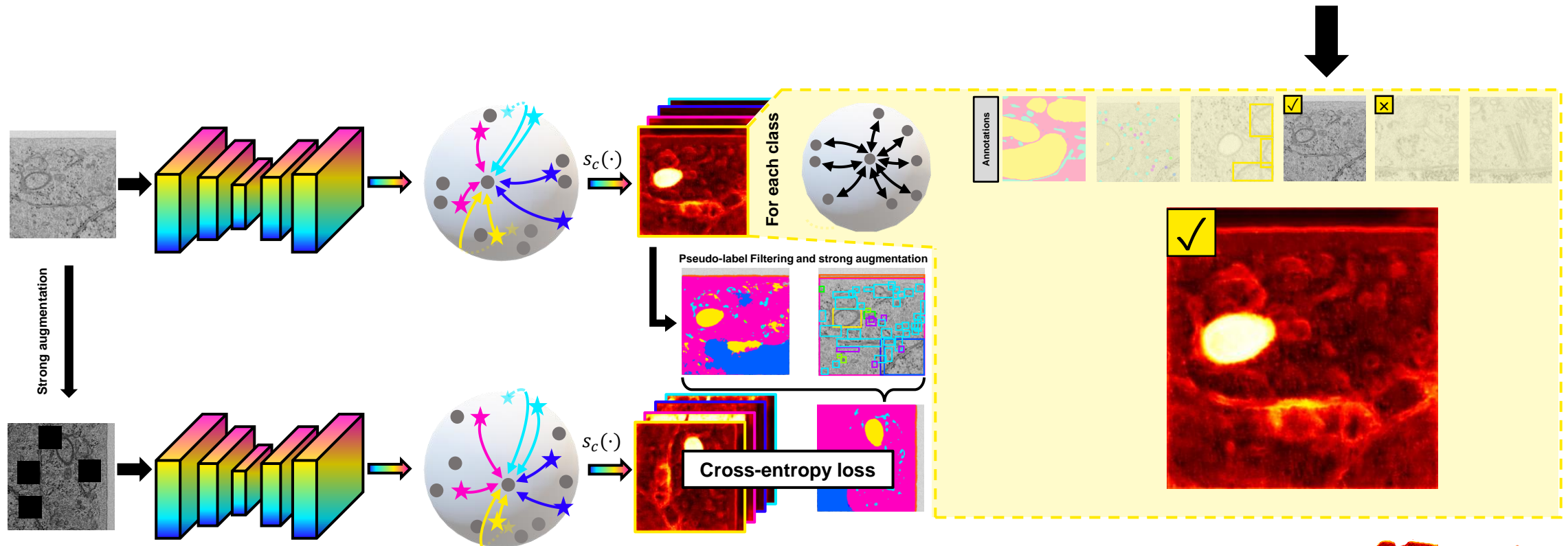
$$L(f_i, c) = -\log \frac{\text{[Heatmap]} \cdot \text{[Point Cloud]}}{\text{[Heatmap]} + \text{[Point Cloud]}}$$

# Training with diverse annotation types



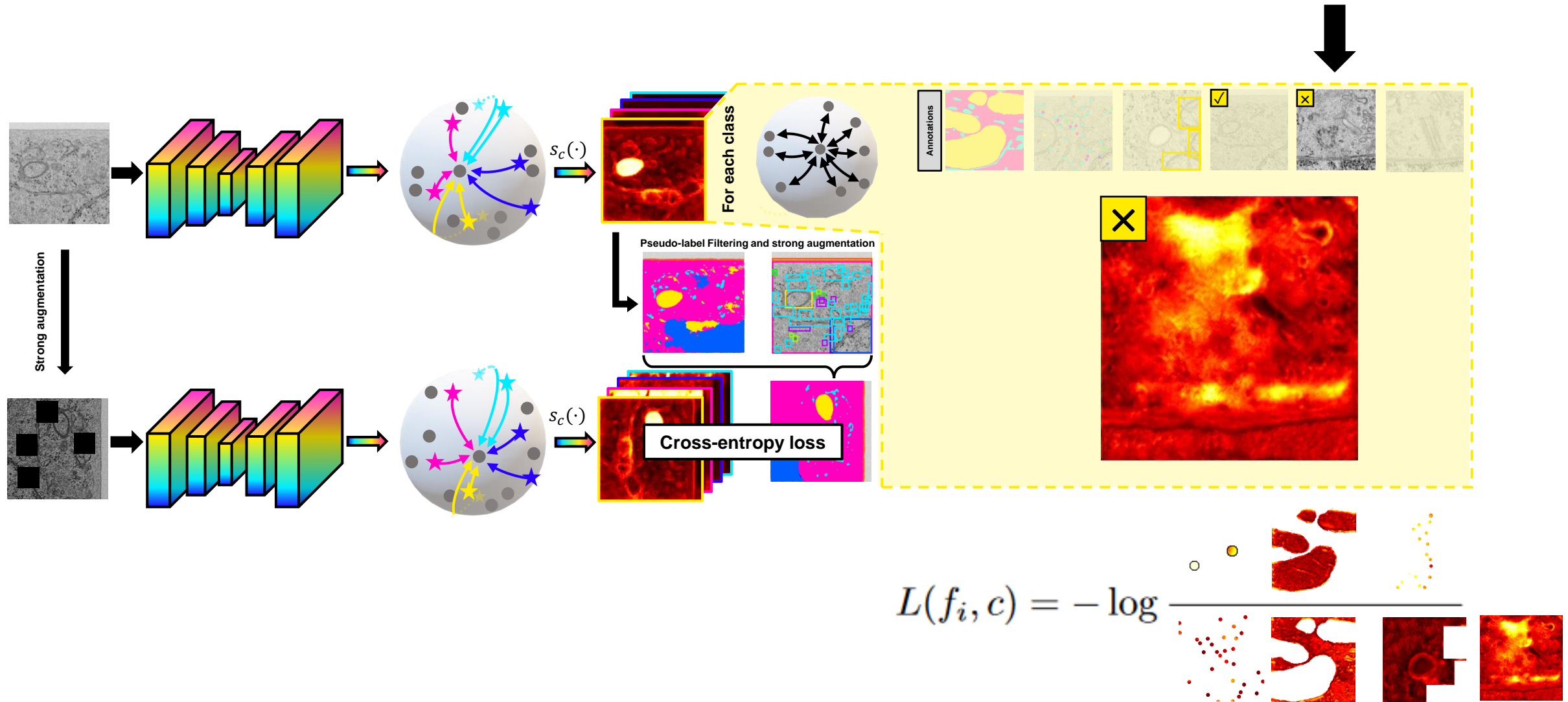
$$L(f_i, c) = -\log \frac{\text{[red feature map]} \cdot \text{[point cloud]}}{\text{[red feature map]} \cdot \text{[white mask]} + \text{[red feature map]} \cdot \text{[red mask]}}$$

# Training with diverse annotation types

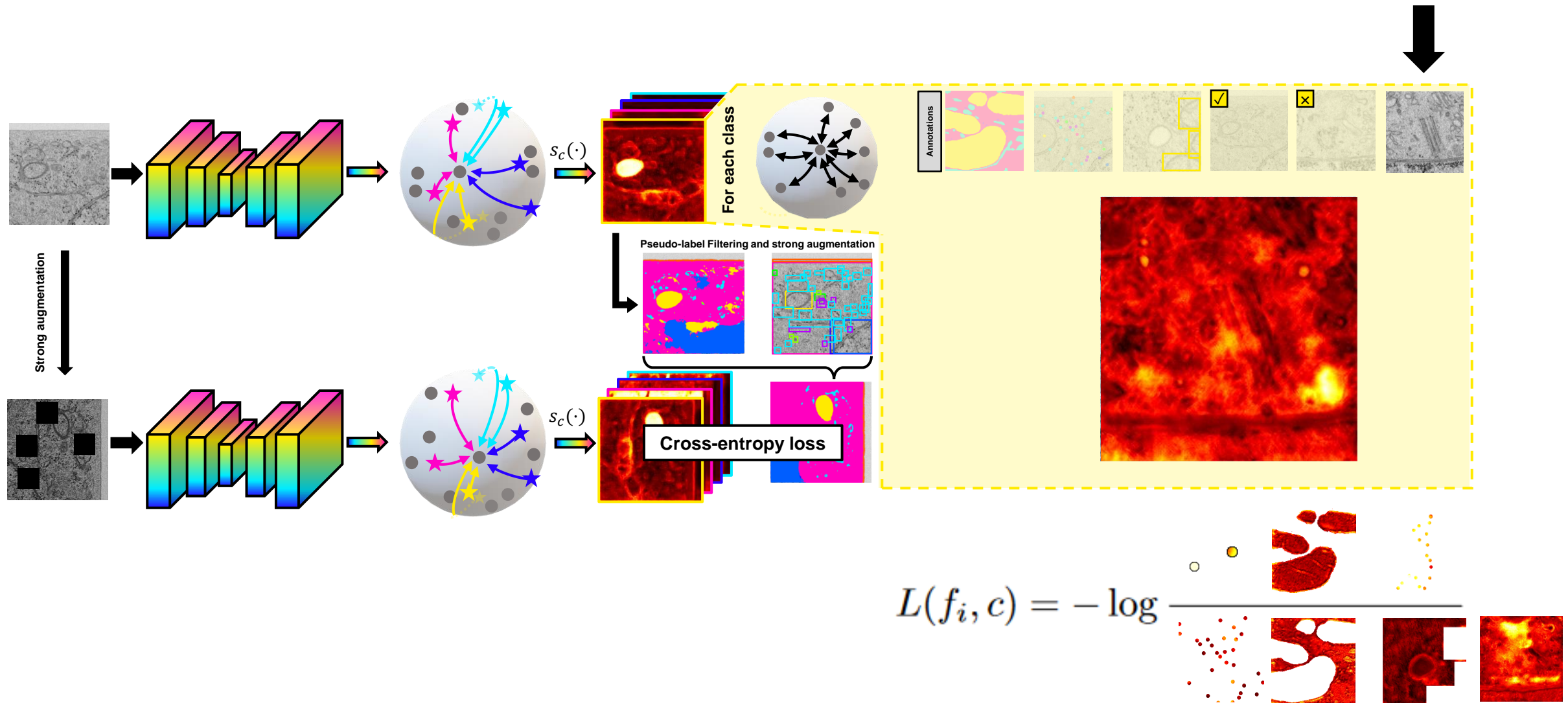


$$L(f_i, c) = -\log \frac{\text{[Heatmap with checkmark]}}{\text{[Heatmap with red dots]}}$$

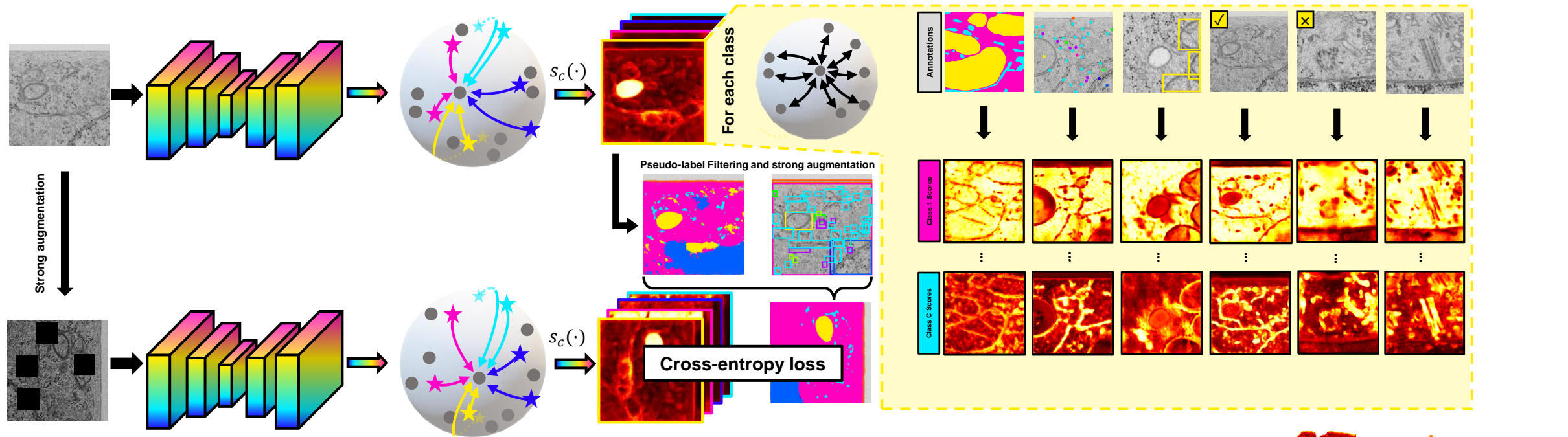
# Training with diverse annotation types



# Training with diverse annotation types



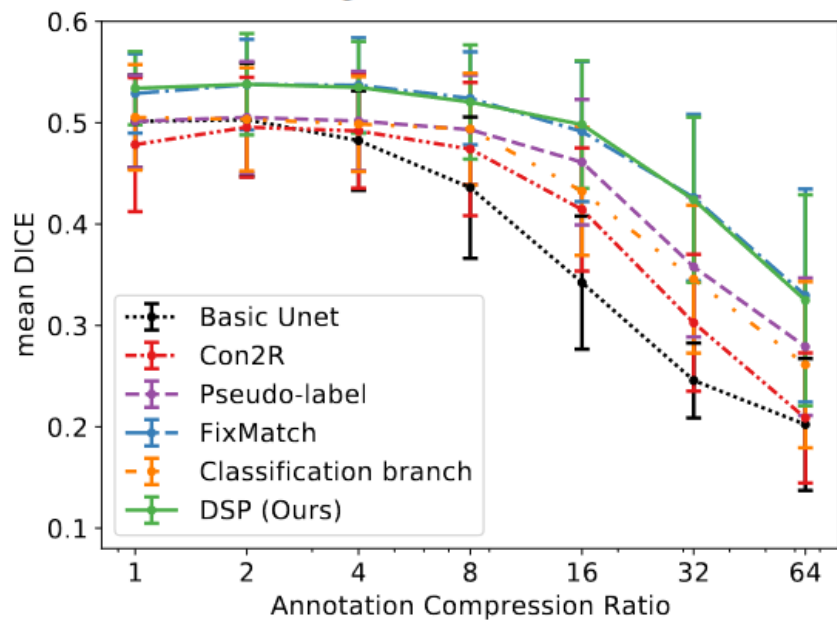
# Training with diverse annotation types



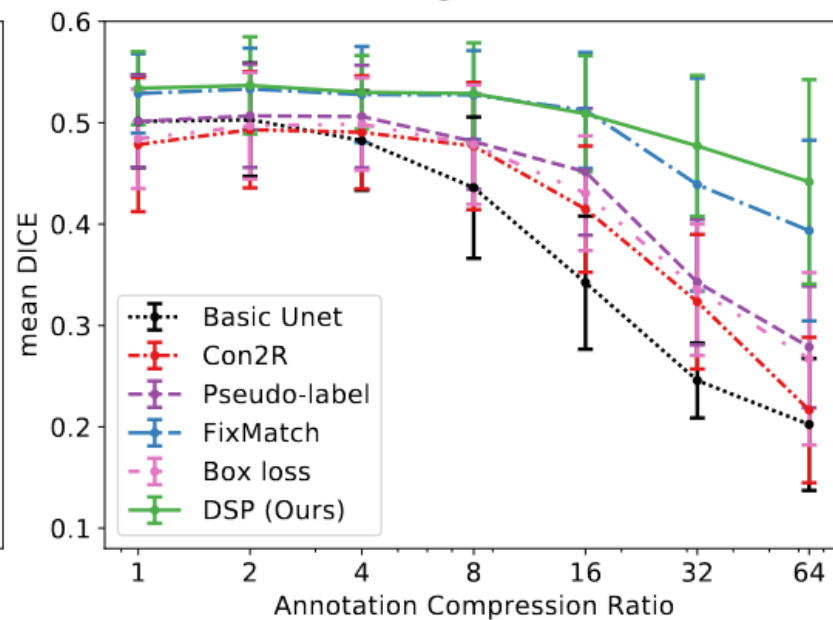
$$L(f_i, c) = -\log \frac{\text{score}(f_i, c)}{\sum_{c'} \text{score}(f_i, c')}$$

# Quantitative results

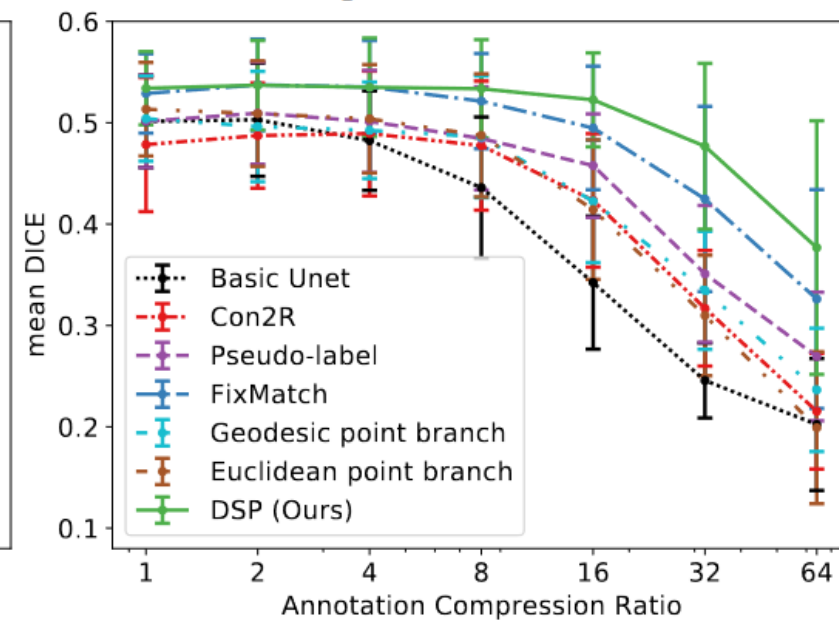
(a) Masks + image-level labels on *HELA-2*.



(b) Masks + bounding boxes on *HELA-2*.



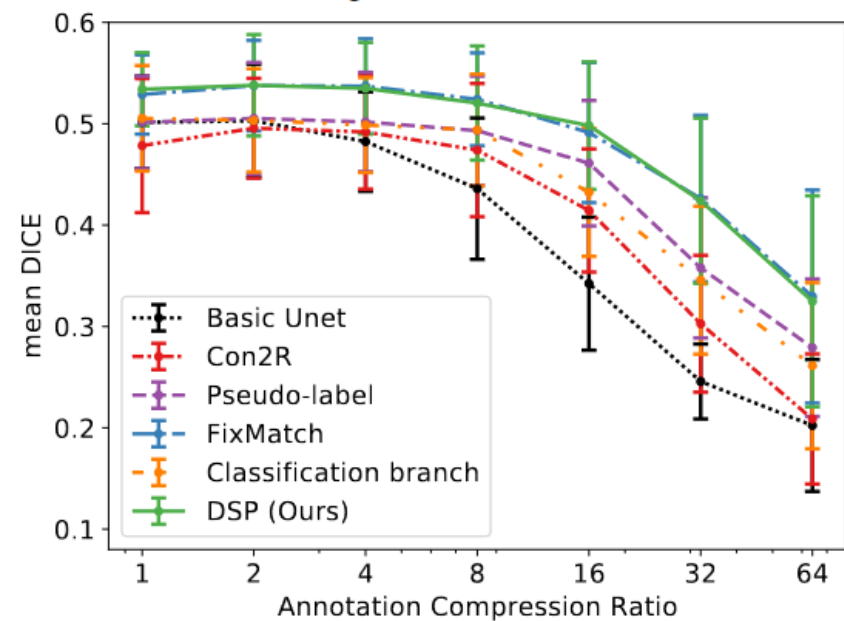
(c) Masks + point labels on *HELA-2*.



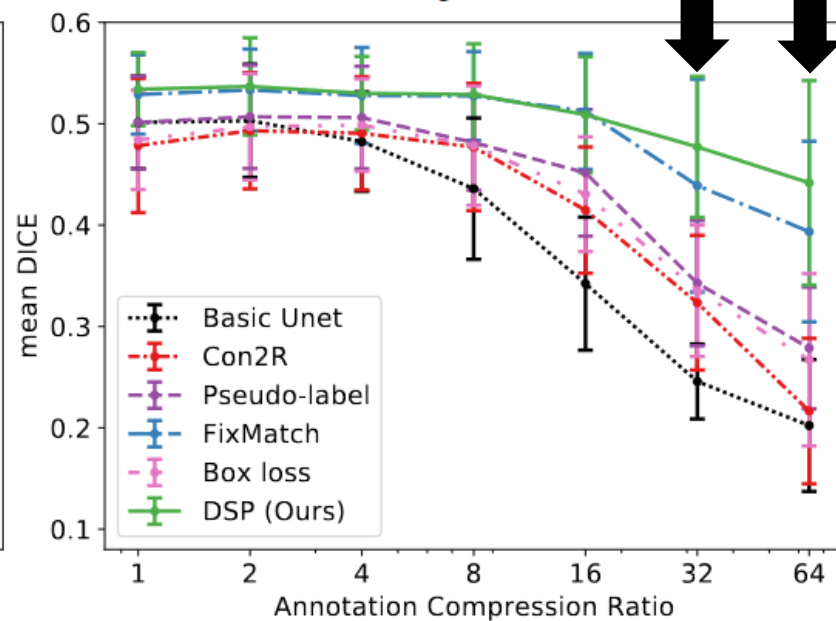


# Quantitative results

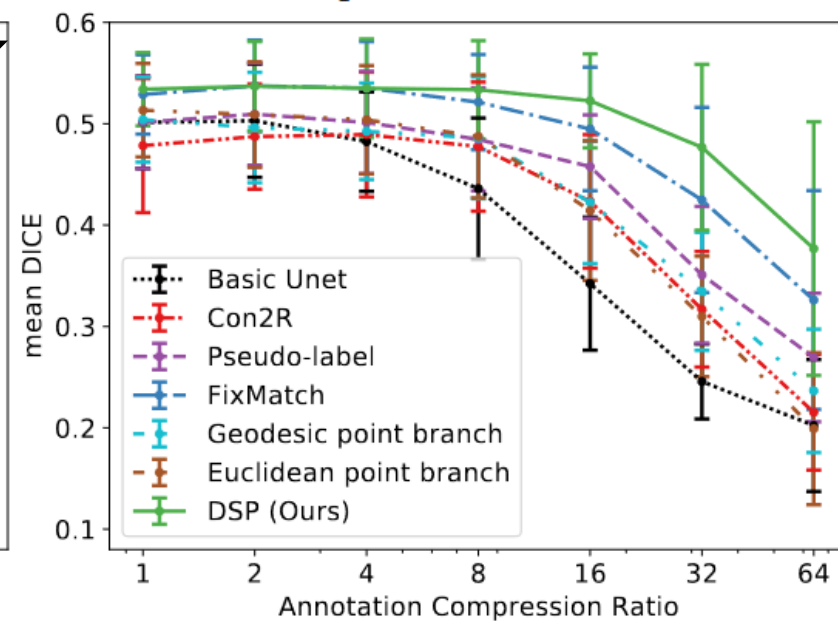
(a) Masks + image-level labels on *HELA-2*.



(b) Masks + bounding boxes on *HELA-2*.

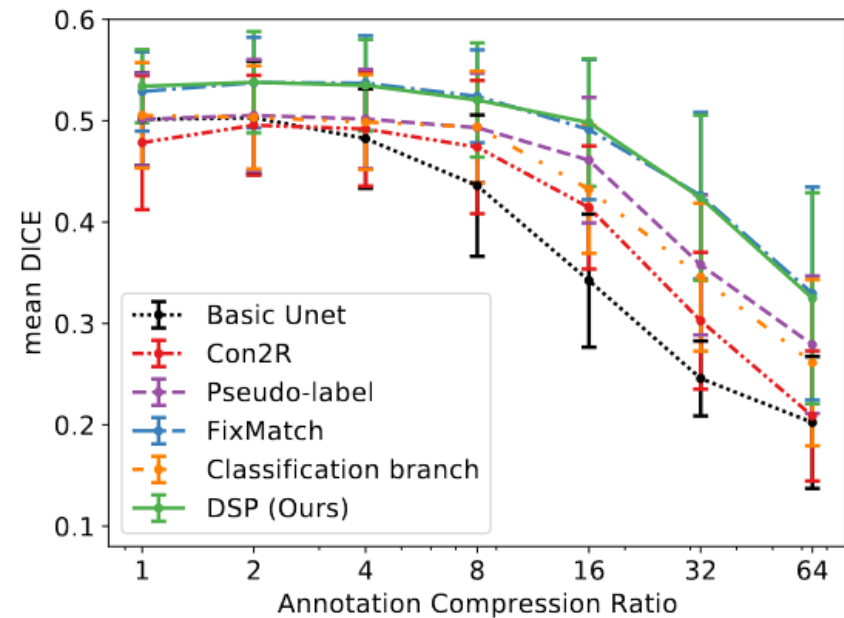


(c) Masks + point labels on *HELA-2*.

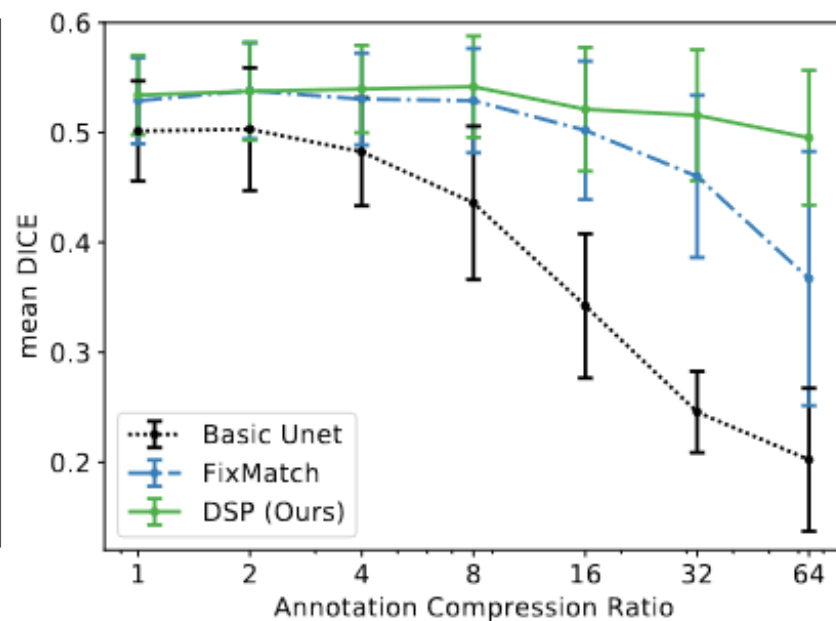


# Quantitative results

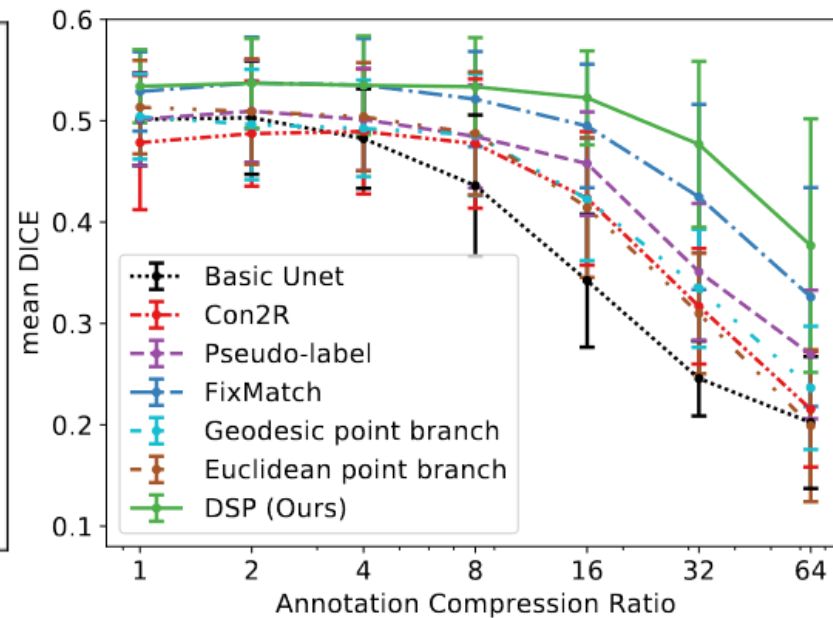
(a) Masks + image-level labels on *HELA-2*.



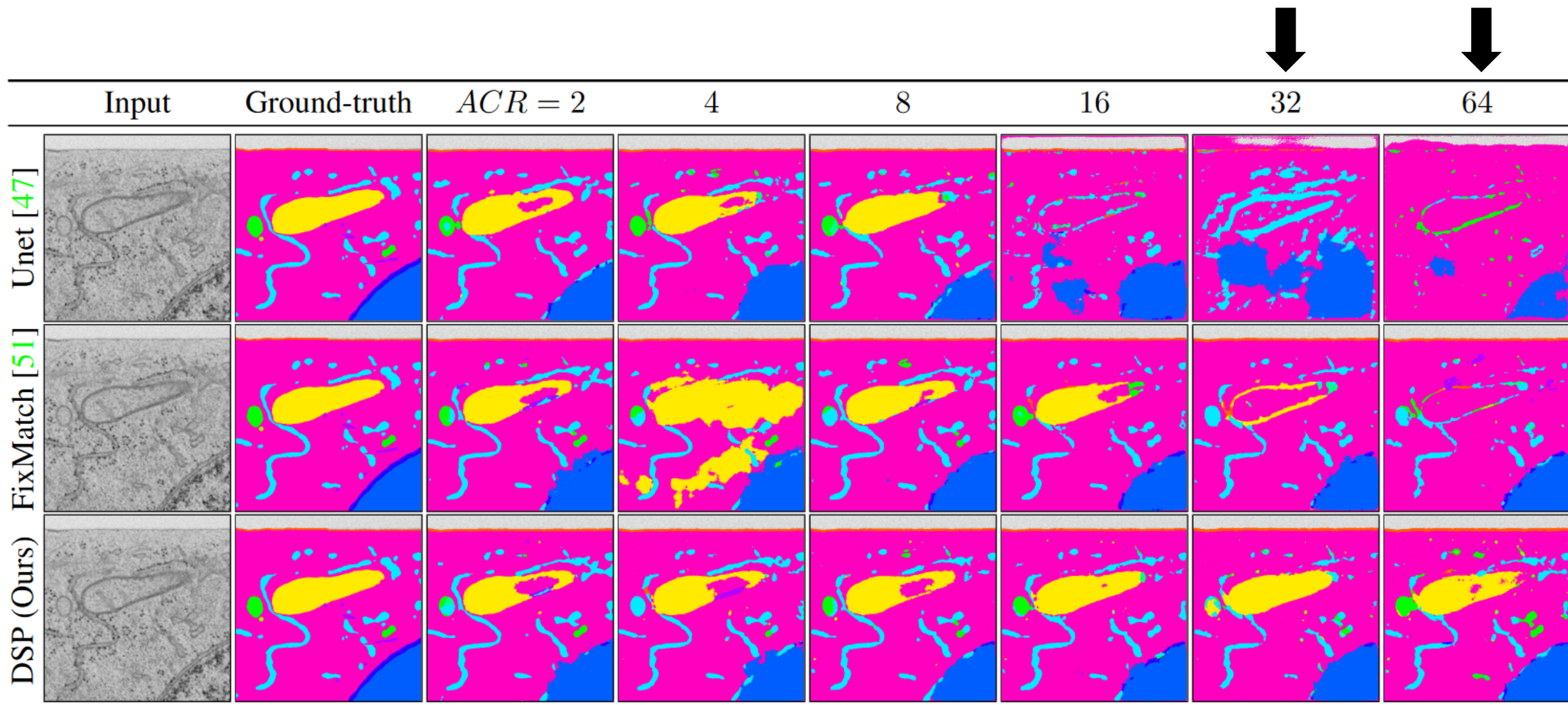
(d) Mixed on *HELA-2*.



(c) Masks + point labels on *HELA-2*.



# Qualitative results



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**CODE ON GITHUB!**