
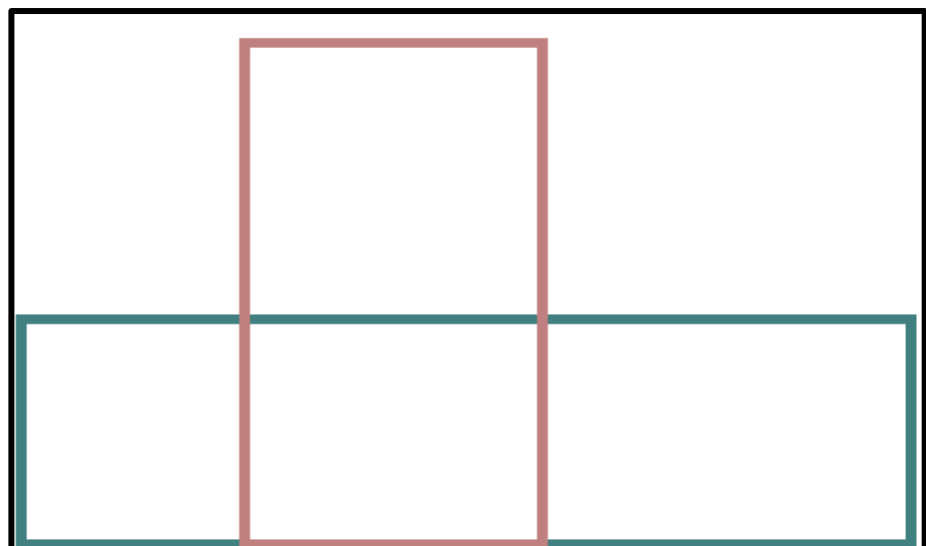
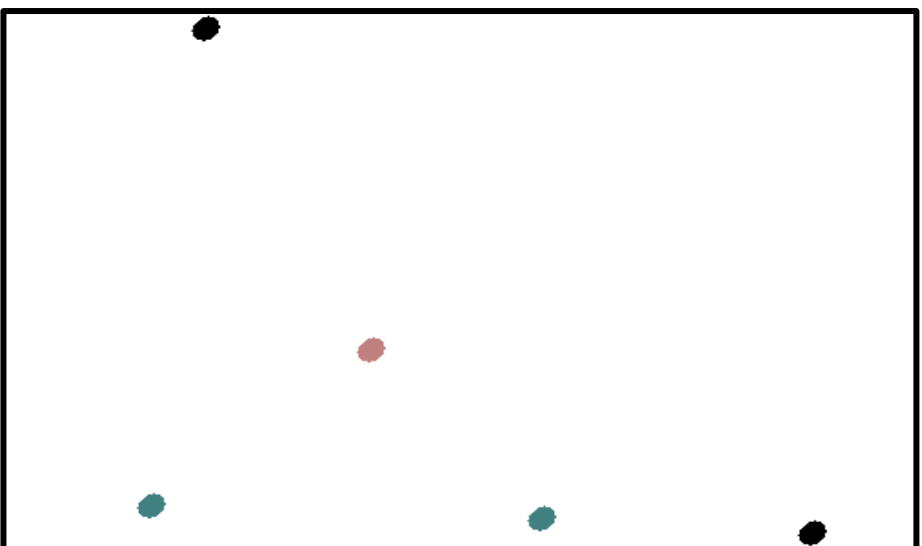
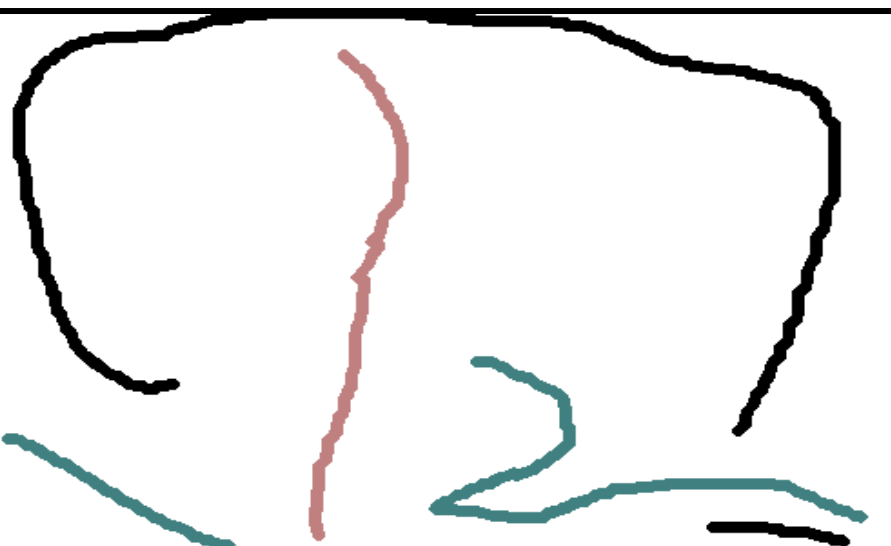
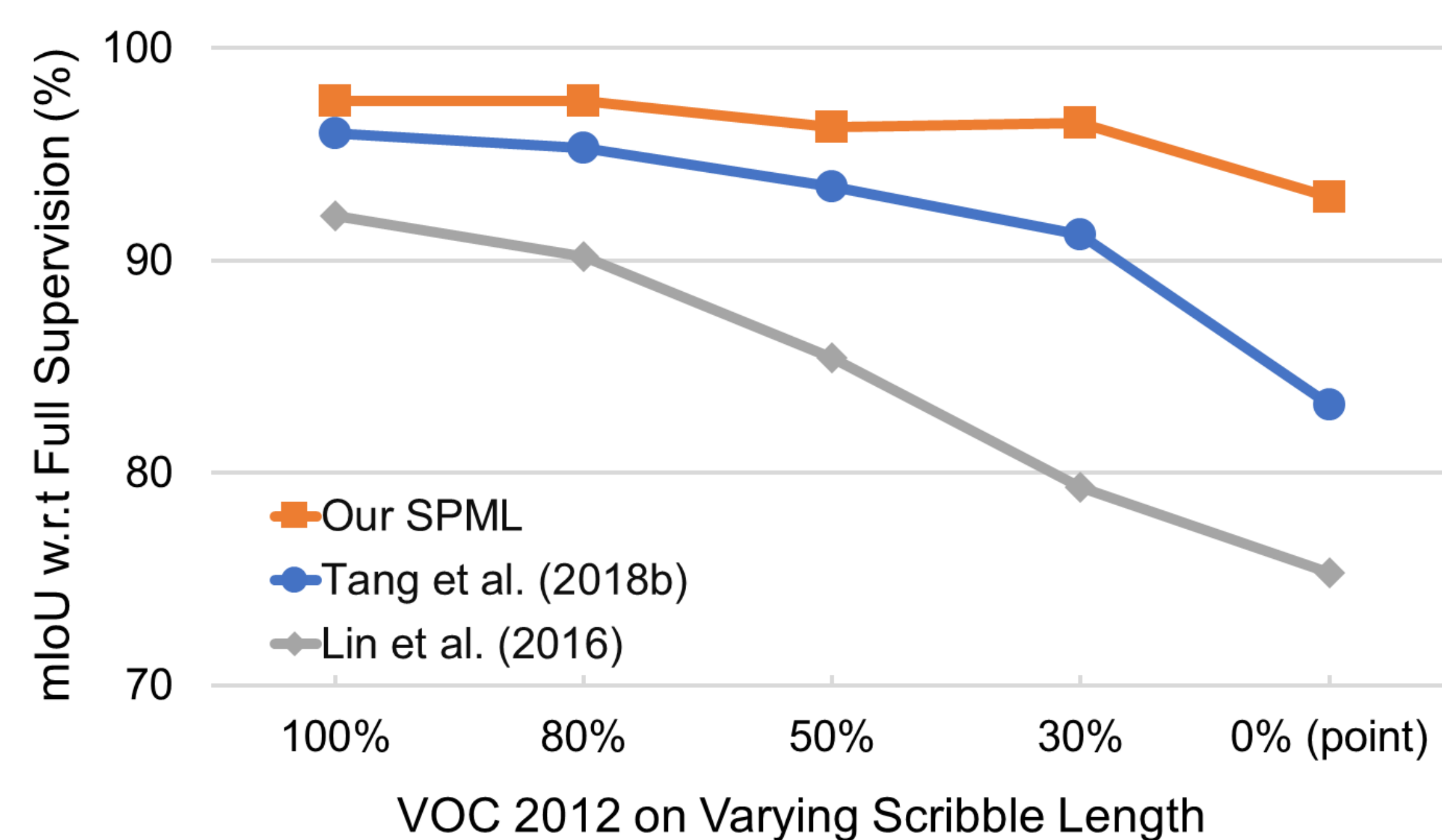
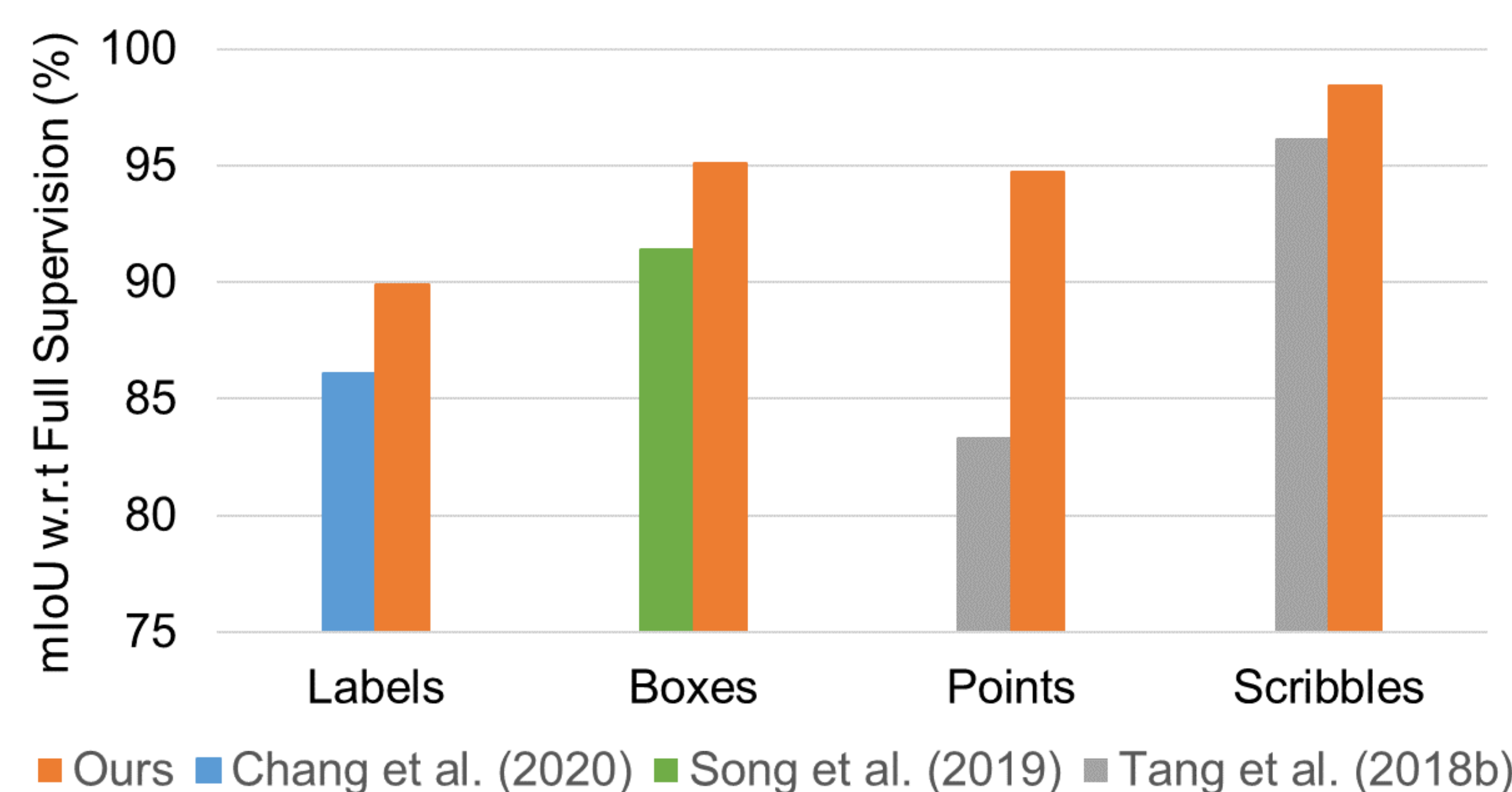




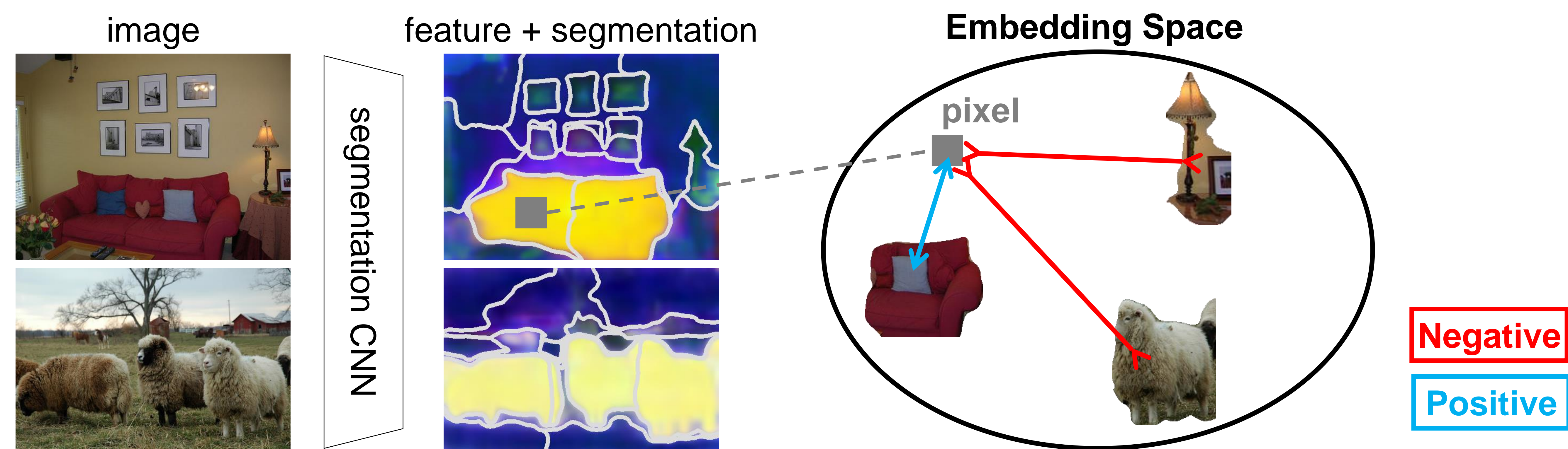
## A Unified Approach for 4 Kinds of Weak Annotations

Image	Image Tags	Boxes	Points	Scribbles
	<div>Person</div> <div>Motorbike</div>			
Supervision	Coarse		Sparse	
Current Methods	Class Activation Maps		Conditional Random Fields	
Our Method	single pixel-to-segment contrastive learning loss formulation			

## Outperforms the State-of-The-Art over All Weak Annotations



## Our SPML: Contrasts Pixels with Segments on 4 Types of Relationships



For pixel  $i$  with positive segments  $\mathcal{C}^+$ , negative segments  $\mathcal{C}^-$ :

$$L_{\text{SegSort}^+}(i, \mathcal{C}^+, \mathcal{C}^-) = -\log \frac{\sum_{t \in \mathcal{C}^+} \exp(\kappa \mu'_t e_i)}{\sum_{t \in \mathcal{C}^+ \cup \mathcal{C}^-} \exp(\kappa \mu'_t e_i)}$$

Overall loss:

$$L(i) = \lambda_I L_{\text{SegSort}^+}(i, \mathcal{V}^+, \mathcal{V}^-) + \lambda_C L_{\text{SegSort}^+}(i, \mathcal{C}^+, \mathcal{C}^-) + \lambda_O L_{\text{SegSort}^+}(i, \mathcal{O}^+, \mathcal{O}^-) + \lambda_A L_{\text{SegSort}^+}(i, \hat{\mathcal{C}}^+, \hat{\mathcal{C}}^-)$$

## Our Results Get Closer to Fully Supervised Counterparts

