

# Uncovering the Inner Workings of STEGO for Safe Unsupervised Semantic Segmentation

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Merantix Momentum

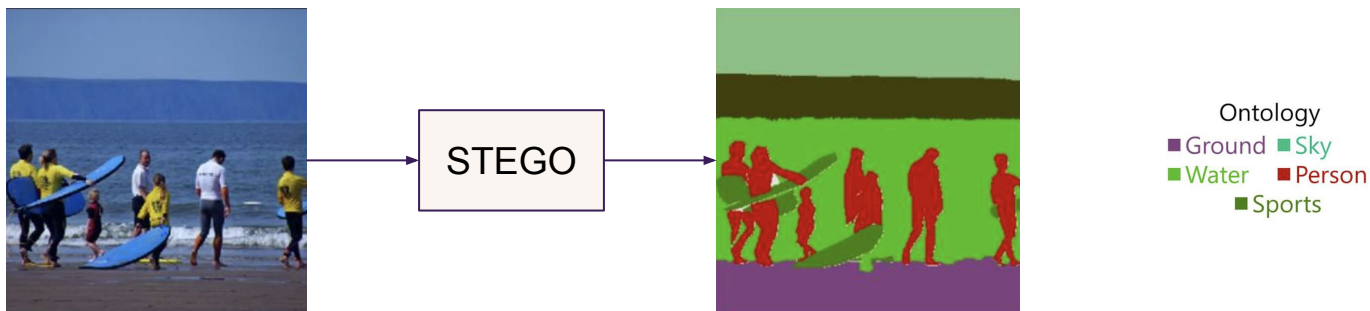
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SAIAD Workshop at CVPR 2023, June 19

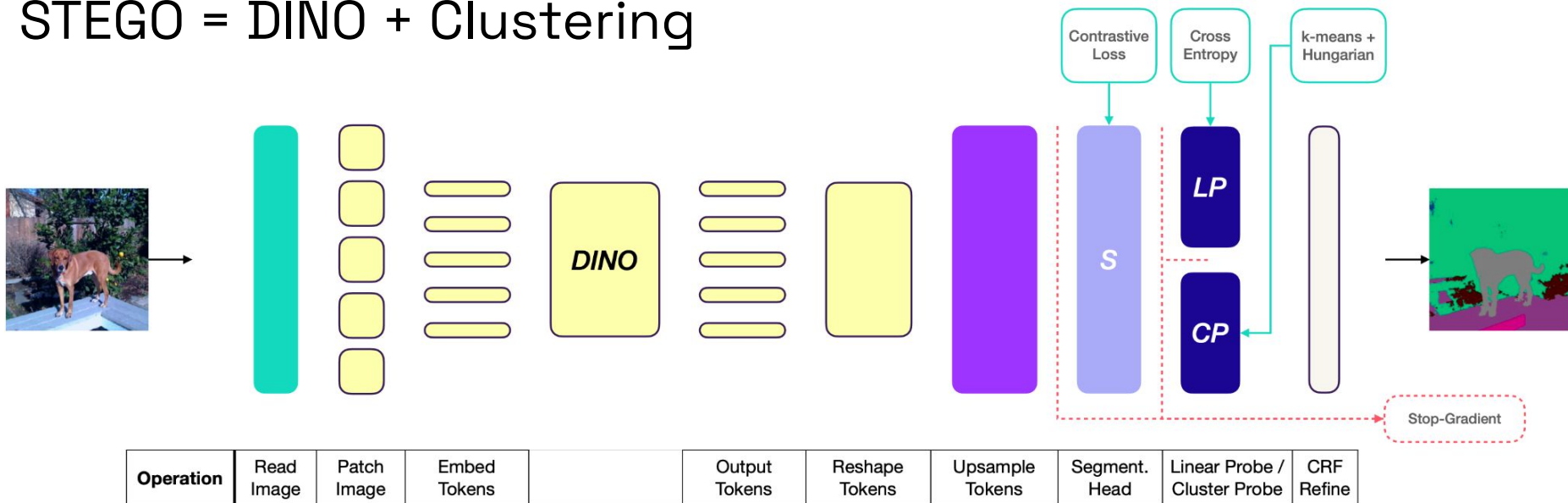


# Motivation

- Problem: labeled data is scarce, but unlabeled data is abundant
- Self-supervised learning recently demonstrated impressive results on unlabeled datasets
- STEGO (Hamilton et al., ICLR 2022) is an algorithm for unsupervised semantic segmentation
- To apply STEGO safely in real-world, it's crucial to understand its working mechanisms



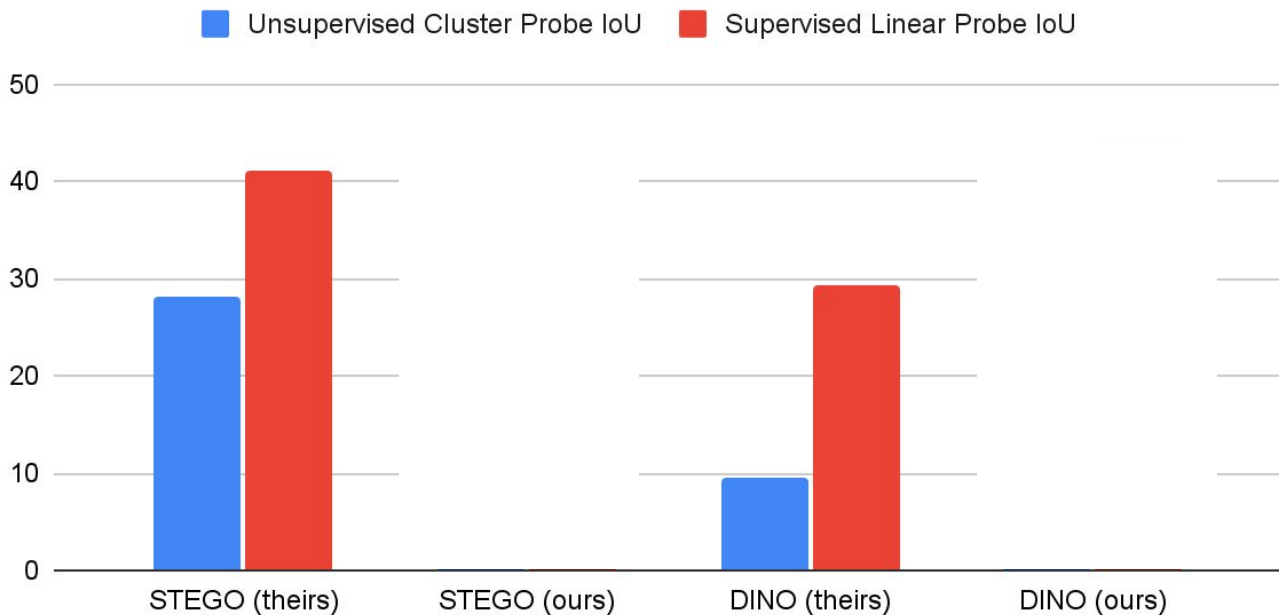
# STEGO = DINO + Clustering



- STEGO builds on DINO (Caron et al., ICCV 2021) pre-trained Vision Transformer
- Segmentation head S projects DINO feats into lower-dimensional space, “distilling” DINO feature correspondences
- CP maps STEGO features to ontologies using k-Means

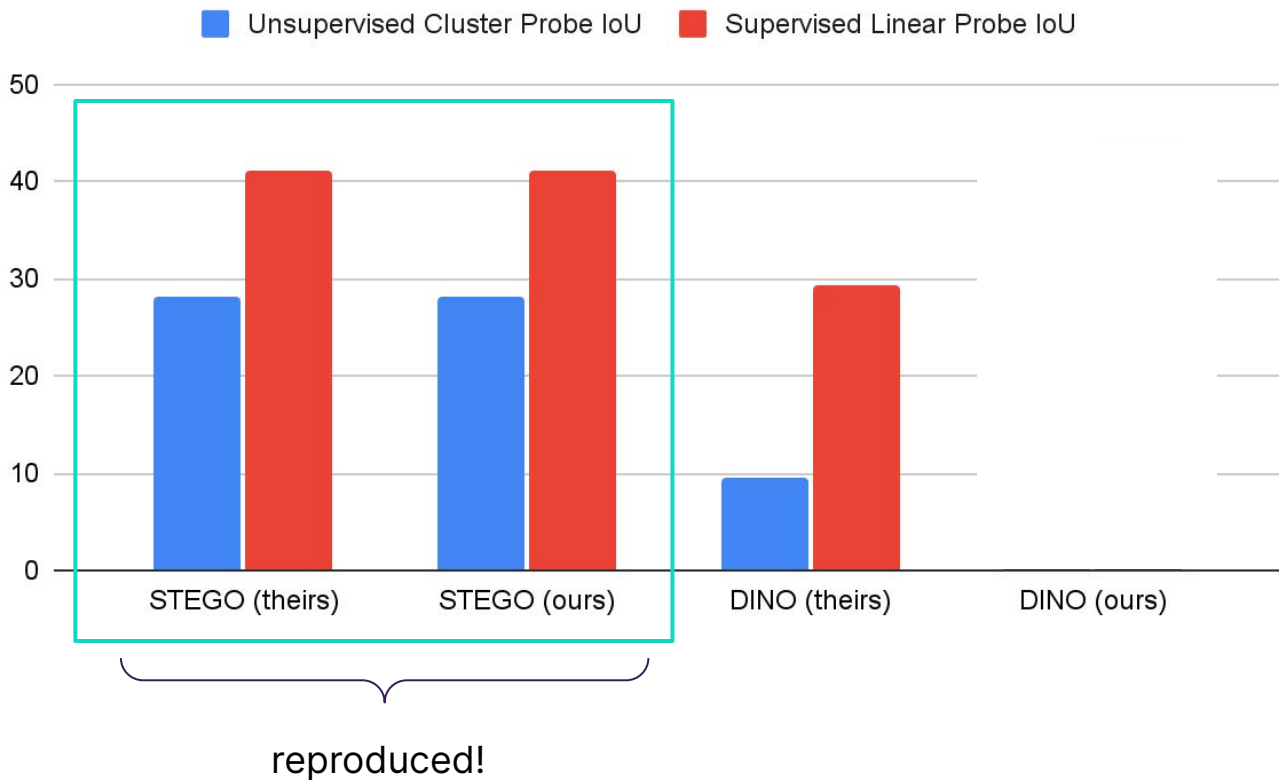
# Reproducibility Cocostuff

**Cluster Probe** = SegHead + K-Means + Hungarian  
**Linear Probe** = SegHead + Lin. Layer + X Entropy



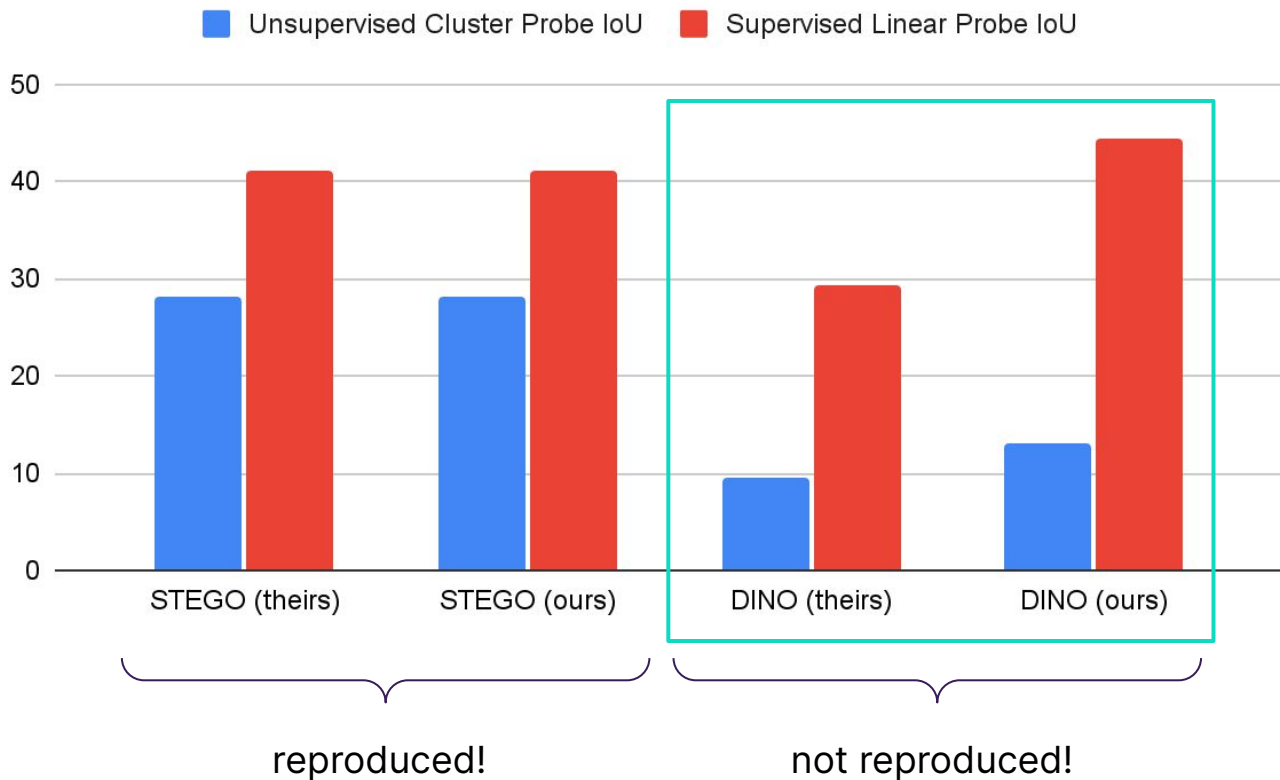
# Reproducibility Cocostuff

**Unsupervised** = SegHead + K-Means + Hungarian  
**Linear Probe** = SegHead + Lin. Layer + X Entropy



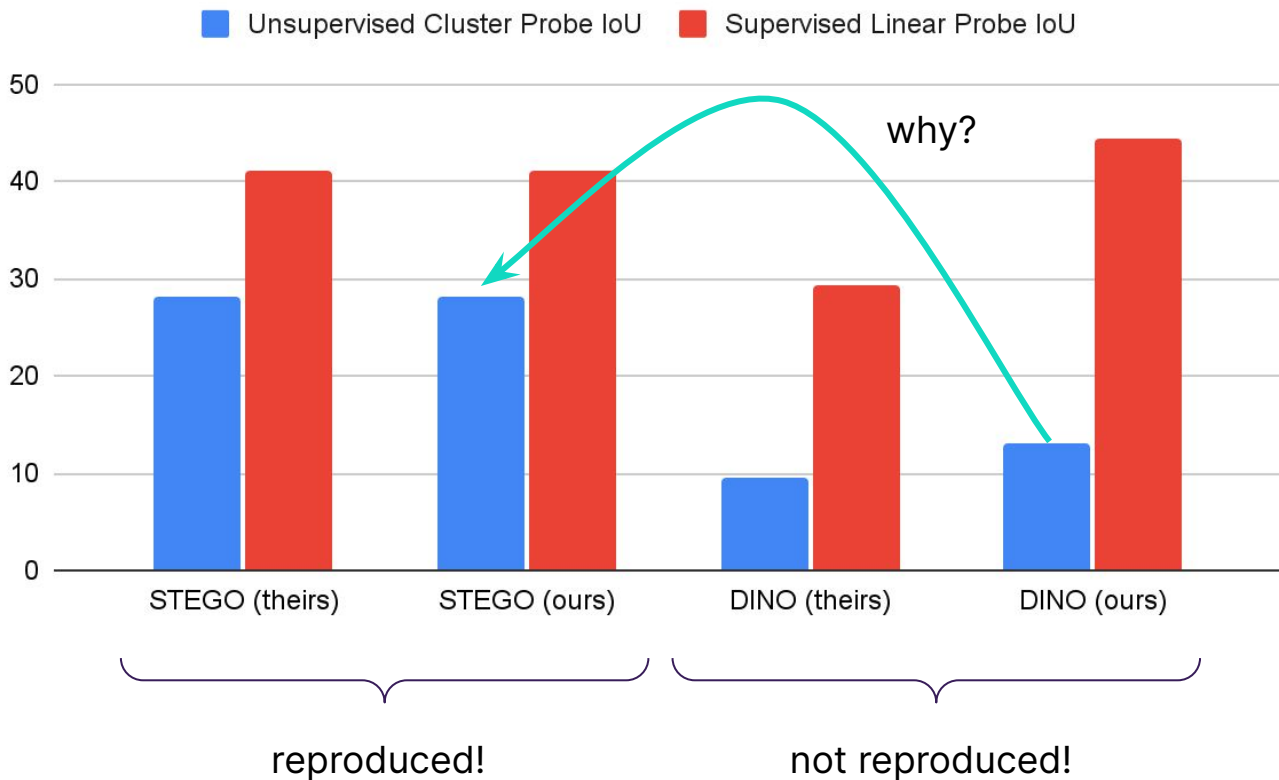
# Reproducibility Cocostuff

**Unsupervised** = SegHead + K-Means + Hungarian  
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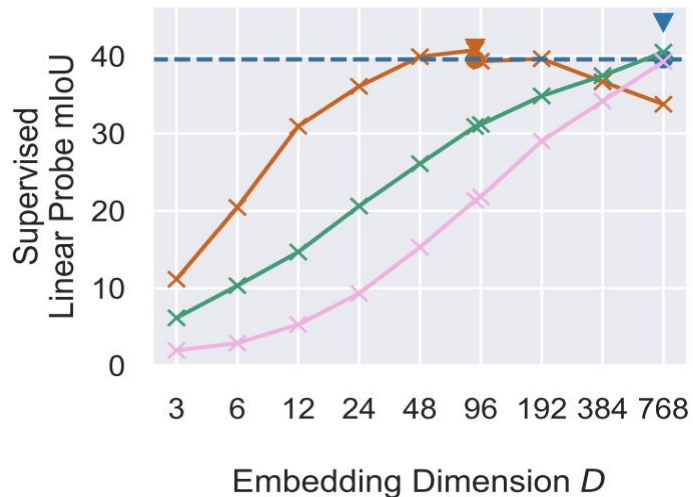


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# STEGO's Working Mechanisms

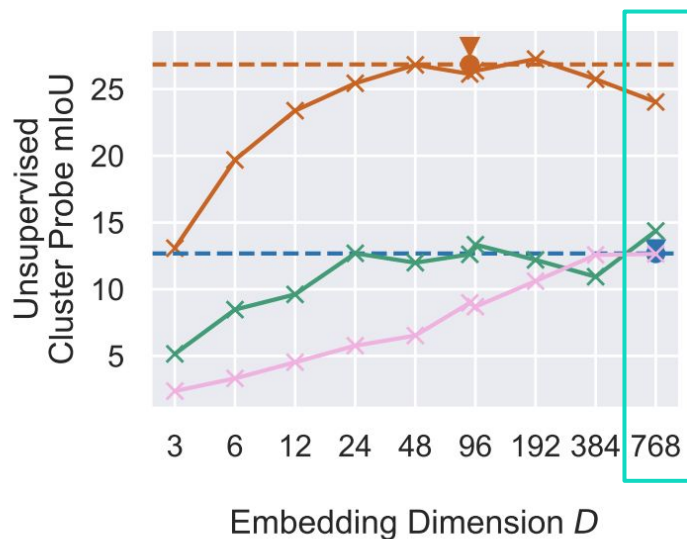


## Working Mechanism 1:

- STEGO is a dimensionality reduction technique
- k-Means converges better in fewer dimensions



# STEGO's Working Mechanisms



## Working Mechanism 2:

- Segmentation head output forms more distinct clusters



# Thank You

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