

# Efficient Masked Attention Transformer for Few-Shot Classification and Segmentation

Project Page

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## TL;DR

EMAT, Efficient Masked Attention Transformer, processes high-resolution correlation tokens, boosting few-shot classification and segmentation, especially for small objects, while using at least four times fewer parameters than existing methods. It supports  $N$ -way  $K$ -shot tasks and outputs empty masks when no target is present.



Figure 1. Qualitative comparison of CST\* (previous SOTA) and EMAT.

## Introduction

Few-shot classification and segmentation (FS-CS) [2] focuses on jointly performing *multi-label classification* and *multi-class segmentation* using few annotated examples.

### Motivation:

- FS-C and FS-S often co-occur in real-world applications.
- Applications such as medical imaging require precise small-object analysis, yet the current SOTA in FS-CS, CST [1], performs poorly on small objects.
- Most FS-S methods are limited to single-class (1-way) segmentation, and the standard multi-class ( $N$ -way) evaluation setting discards useful annotations.

**Goal:** Enhance efficiency and FS-CS accuracy, particularly for small objects, and better utilize annotations during evaluation.

## Problem Definition

In  $N$ -way  $K$ -shot FS-CS, a **support set** provides  $N$  classes with  $K$  examples each, and the goal is to identify which support classes appear in the **query image** (multi-label classification) and segment them (multi-class segmentation). Here, unlike the standard definition, the query image may contain: (1) none, (2) a subset, or (3) all of the support classes.

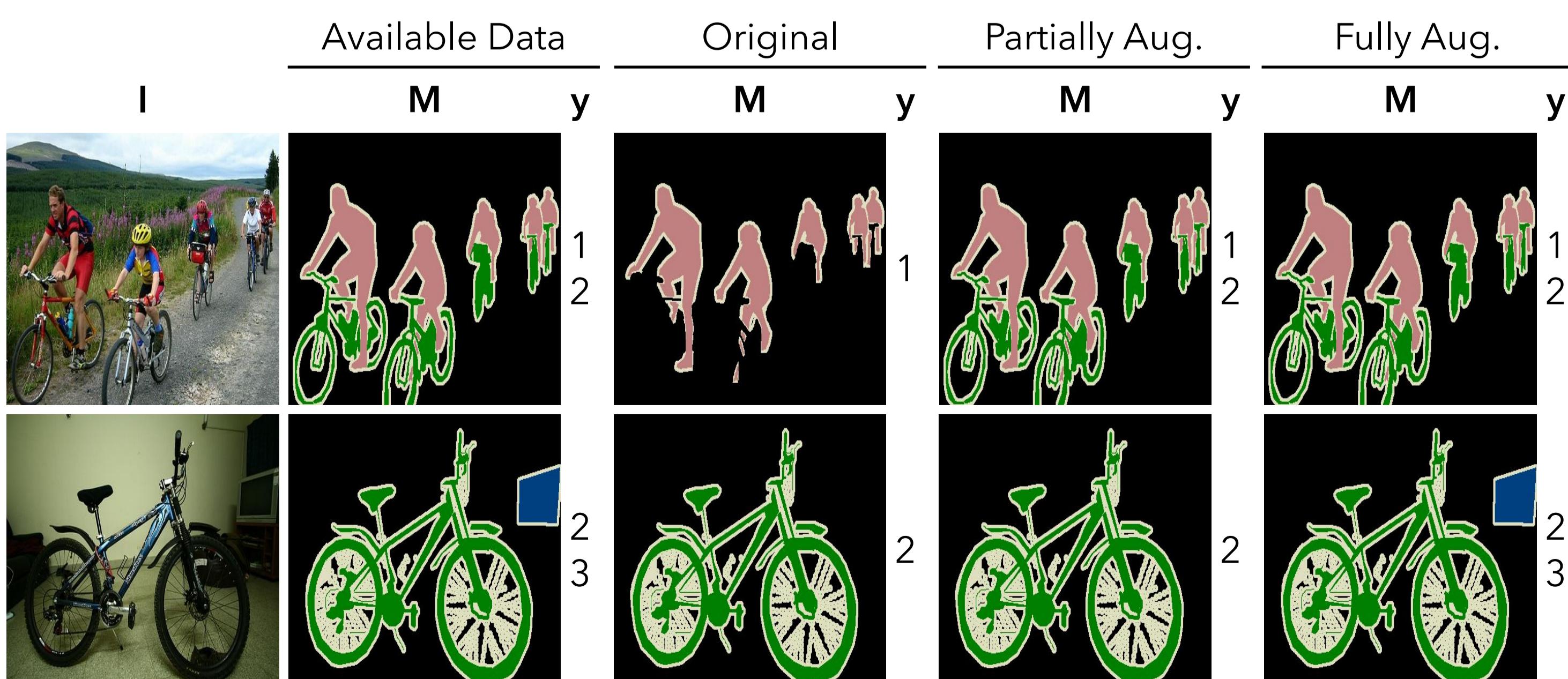


Figure 2. Support set of a 2-way 1-shot task across all evaluation settings.

## Method

EMAT processes correlation features extracted with a frozen pre-trained ViT-S [3] using a two-layer transformer with:

- (1) A memory-efficient masked attention formulation,
- (2) A learnable downscaling strategy,
- (3) Modifications for improved parameter efficiency.

Task-specific heads then predict the multi-label classification vector and the multi-class segmentation mask.

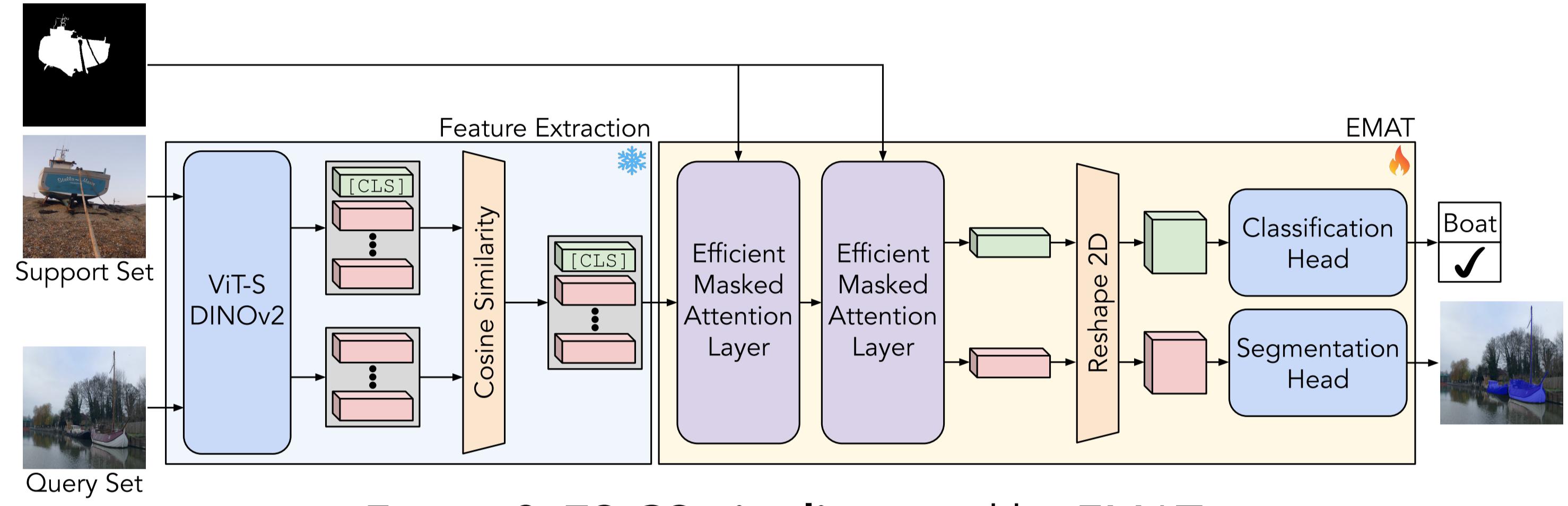


Figure 3. FS-CS pipeline used by EMAT.

## Results

Table 1. Comparison of FS-CS methods on 2-way 1-shot tasks across all evaluation settings using COCO-20i [4].

Method	Trainable Params.	Original		Partially Aug.		Fully Aug.	
		Acc.	mIoU	Acc.	mIoU	Acc.	mIoU
PANet [5]	23.51	51.30	23.64	51.32	23.78	45.07	23.17
HSNet [6]	2.57	62.43	30.58	62.40	30.66	55.15	29.44
ASNet [2]	1.32	63.05	31.62	63.03	31.64	55.47	30.47
CST* [1]	0.37	78.70	51.47	78.87	51.53	71.18	50.76
EMAT	<b>0.09</b>	<b>80.07</b>	<b>52.81</b>	<b>80.25</b>	<b>52.82</b>	<b>73.00</b>	<b>51.99</b>

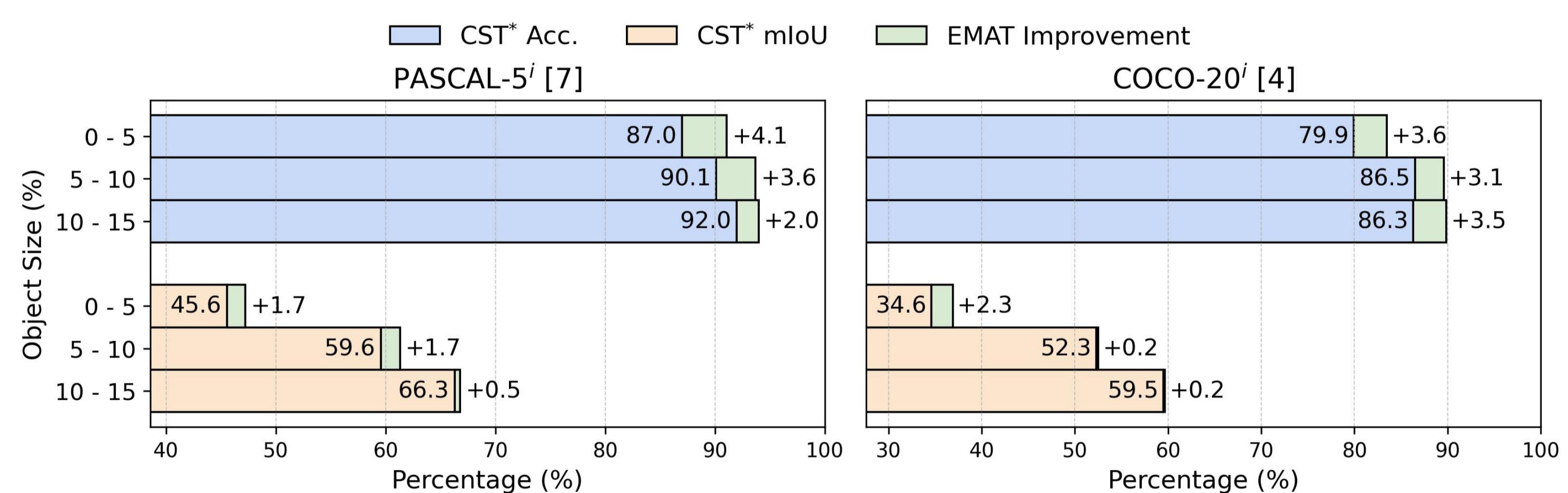


Figure 4. Small-object analysis with 1-way 1-shot tasks.

## Conclusion

- EMAT achieves SOTA performance with  $\sim 4\times$  fewer parameters.
- High-resolution tokens boost accuracy on small-objects.
- Our evaluation settings maximize annotation usage.

## References & Acknowledgements

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