

## **Problem Statement**

- Training: Sufficiently many images with ground-truth segmentation of base classes.
- Testing: Few support images with ground-truth segmentation of a target class, and a query image. The training and test sets do no share the same object classes.
- Goal: Segment the target class in a query image.

## **A Typical Approach**



## Motivation

The box head of Mask-RCNN is anchor-based overfitting to particular sizes and aspect ratios of training classes

The mask head of Mask-RCNN learns feature prototypes capturing global outlines of objects Overfitting to the shapes of training classes

# FAPIS: A Few-shot Anchor-free Part-based Instance Segmenter Khoi Nguyen and Sinisa Todorovic

## **Our Approach**

## Support feature vector $f_s$ Feature Extraction (prev. Fig.) Head Head -----> Conditional query feature maps Segmenter (PIS) Query image $x_q$ Support image $x_s$ Support mask m**Convolutional layers** ROI-align pooling

#### **Table 1.** Performance with different numbers of parts on COCO-20<sup>0</sup>

# parts	1	2	4	8	16	32	64
mAP50	16.3	17.2	17.9	18.4	18.8	18.5	18.0

#### **Table 2.** mAP50 with std of one and five-shot instance segmentation on COCO-20<sup>i</sup>

# shots	Method	$\mathbf{COCO-}20^{0}$	$COCO-20^{1}$	<b>COCO-</b> $20^2$	<b>COCO-</b> $20^3$	mean
K=1	Meta-RCNN (Yan et al., ICCV 19)	$16.0 \pm 0.6$	$16.1 \pm 0.5$	$15.8 \pm 0.3$	$18.6 \pm 0.4$	16.6
	Siamese M-RCNN (Michaelis et al., Arxiv 18)	$16.6 \pm 0.8$	$16.6 \pm 0.6$	$16.3 \pm 0.7$	$19.3 \pm 0.6$	17.2
	YOLACT (Bolya et al., ICCV 19)	$16.8\pm0.6$	$16.5 \pm 0.5$	$16.1 \pm 0.4$	$19.0 \pm 0.6$	17.1
	FAPIS	$\textbf{18.8} \pm \textbf{0.3}$	$17.7\pm0.1$	$18.2\pm0.7$	$\textbf{21.4} \pm \textbf{0.4}$	19.0
K=5	Meta-RCNN (Yan et al., ICCV 19)	$17.4 \pm 0.3$	$17.8 \pm 0.2$	$17.7 \pm 0.7$	$21.3 \pm 0.2$	18.6
	Siamese M-RCNN (Michaelis et al., Arxiv 18)	$17.5 \pm 0.4$	$18.5 \pm 0.1$	$18.2 \pm 1.0$	$22.4 \pm 0.2$	19.2
	YOLACT (Bolya et al., ICCV 19)	$17.6 \pm 0.2$	$18.4 \pm 0.2$	$17.9 \pm 0.6$	$21.8 \pm 0.3$	18.9
	FAPIS	$\textbf{20.2} \pm \textbf{0.2}$	$20.0 \pm 0.1$	$   20.4 \pm 0.7 \\$	$\begin{array}{ } \textbf{24.3} \pm \textbf{0.2} \end{array}$	21.2

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**Contribution 1:** Anchor-free object detector

**Contribution 2:** Part-based instance segmenter











#### **Visualization of Learned Latent Parts**

(d) 10 most relevant parts with blue (lowest) to green (highest))

### **Qualitative Results**