Multi-Scale Positive Sample Refinement for Few-Shot Object Detection

Supplementary Material

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1 Ablation of Refinement in the Two-Step Training

By default, we apply the refinement branch to detectors during both training steps for consistency. To reveal the effectiveness of our method in the two steps, we evaluate detectors with refinement only during base training or few-shot fine-tuning individually. As shown in Table 1, refining detectors only during base training gets better results than Baseline-FPN, which means detection at various scales benefits from our method to some extent. Refining detectors only during few-shot fine-tuning exceeds refining base only and Baseline-FPN by a large margin when the number of instances is extremely small (*e.g.* 1 or 3), which demonstrates that our method relieves the unique sparsity of scales in FSOD. Besides, refining detectors during both base training and few-shot fine-tuning achieves the best results, indicating that the two steps play complementary roles.

Table 1. mAP (%) of novel classes on VOC split-1 applying refinement during different training stages

Method/Shot	1	3	5	10
Baseline-FPN	25.5	41.1	49.6	56.9
Only Base	26.6	43.5	50.7	59.4
Only Few-shot	36.5	47.3	50.6	59.0
Both Steps	**41.7**	**51.4**	**55.2**	**61.8**

2 Complete Results on PASCAL VOC

As shown in Table 2, we present the complete results on PASCAL VOC as in [2]. In this table, we also supply the 2-shot experimental results for consistency.

References

1. Kang, B., Liu, Z., Wang, X., Yu, F., Feng, J., Darrell, T.: Few-shot object detection via feature reweighting. In: The IEEE International Conference on Computer Vision (ICCV) (2019)
2. Yan, X., Chen, Z., Xu, A., Wang, X., Liang, X., Lin, L.: Meta r-cnn: Towards general solver for instance-level low-shot learning. In: The IEEE International Conference on Computer Vision (ICCV) (2019)

Table 2. AP (%) of each novel class on the few-shot VOC datasets. mAP (%) of novel classes are also presented

		Class Split 1						Class Split 2						Class Split 3					
Shot	Method	bird	bus	cow	mbike	sofa	mean	aero	bottle	cow	horse	sofa	mean	boat	cat	mbike	sheep	sofa	mean
1	YOLO-FS [1]	13.5	10.6	31.5	13.8	4.3	14.8	11.8	9.1	15.6	23.7	18.2	15.7	10.8	44.0	17.8	18.1	5.3	19.2
	Meta R-CNN [2]	6.1	32.8	15.0	35.4	0.2	19.9	**23.9**	0.8	23.6	3.1	0.7	10.4	0.6	31.1	28.9	11.0	0.1	14.3
	Baseline	21.0	14.3	21.6	50.6	15.0	24.5	12.7	9.1	9.7	**42.5**	9.8	16.7	9.9	47.0	43.7	24.1	11.9	27.3
	Baseline-FPN	25.2	9.2	22.1	52.1	18.8	25.5	20.7	**9.4**	19.4	13.1	15.0	15.5	11.4	41.6	42.7	35.9	17.8	29.9
	MPSR (ours)	**33.5**	**41.2**	**57.6**	**54.5**	**21.6**	**41.7**	21.2	9.1	**36.0**	30.9	**25.1**	**24.4**	**14.9**	**47.8**	**57.7**	**34.7**	**22.8**	**35.6**
2	YOLO-FS [1]	21.2	12.0	16.8	17.9	9.6	15.5	28.6	0.9	27.6	0.0	19.5	15.3	5.3	46.4	18.4	26.1	12.4	21.7
	Meta R-CNN [2]	17.2	**34.4**	43.8	31.8	0.4	25.5	12.4	0.1	44.4	**50.1**	0.1	19.4	10.6	24.0	36.2	19.2	0.8	18.2
	Baseline	36.5	10.6	39.5	55.2	26.3	33.6	31.9	9.1	**45.5**	18.3	22.8	25.5	6.8	**49.7**	52.6	35.7	22.9	33.5
	Baseline-FPN	31.3	15.1	41.2	51.5	25..9	33.0	**39.5**	5.6	42.6	19.5	24.4	26.3	16.5	46.5	**61.4**	34.5	25.7	36.9
	MPSR (ours)	**38.2**	28.6	**56.5**	**57.3**	**32.0**	**42.5**	36.5	**9.1**	45.1	21.6	**34.2**	**29.3**	**17.9**	49.6	59.2	**49.2**	**32.9**	**41.8**
3	YOLO-FS [1]	26.1	19.1	40.7	20.4	27.1	26.7	29.4	4.6	34.9	6.8	37.9	22.7	11.2	39.8	20.9	23.7	33.0	25.7
	Meta R-CNN [2]	30.1	44.6	50.8	38.8	10.7	35.0	25.2	0.1	**50.7**	**53.2**	18.8	29.6	**16.3**	39.7	32.6	**38.8**	10.3	27.5
	Baseline	34.9	26.9	53.3	50.8	38.2	40.8	42.8	6.1	49.6	42.0	34.2	34.9	14.4	54.8	48.1	32.4	31.8	36.3
	Baseline-FPN	32.6	29.4	45.5	56.2	41.7	41.1	48.7	**9.7**	46.3	42.4	41.4	37.7	10.7	48.1	**57.3**	31.9	41.3	37.9
	MPSR (ours)	**35.1**	**60.6**	**56.6**	**61.5**	**43.4**	**51.4**	**49.2**	9.1	47.1	46.3	**44.3**	**39.2**	14.4	**60.6**	57.1	37.2	**42.3**	**42.3**
5	YOLO-FS [1]	31.5	21.1	39.8	40.0	37.0	33.9	33.1	9.4	38.4	25.4	44.0	30.1	14.2	**57.3**	50.8	38.9	41.6	40.6
	Meta R-CNN [2]	35.8	47.9	54.9	55.8	34.0	45.7	28.5	0.3	**50.4**	**56.7**	38.0	34.8	16.6	45.8	53.9	41.5	48.1	41.2
	Baseline	36.9	30.7	**59.9**	57.4	37.8	44.6	46.7	**11.9**	41.5	46.0	39.0	37.0	17.9	53.3	54.6	42.8	37.4	41.2
	Baseline-FPN	**40.9**	52.1	45.2	64.3	45.6	49.6	**50.0**	11.2	39.7	48.2	45.3	38.9	20.2	48.7	67.6	47.0	**48.2**	46.3
	MPSR (ours)	39.7	**65.5**	55.1	**68.5**	**47.4**	**55.2**	47.8	10.4	45.2	47.5	**48.8**	**39.9**	**20.9**	56.6	**68.1**	**48.4**	45.8	**48.0**
10	YOLO-FS [1]	30.0	62.7	43.2	60.6	39.6	47.2	43.2	13.9	41.5	58.1	39.2	39.2	20.1	51.8	55.6	42.4	36.6	41.3
	Meta R-CNN [2]	**52.5**	55.9	52.7	54.6	41.6	51.5	**52.8**	3.0	52.1	**70.0**	49.2	45.4	13.9	**72.6**	58.3	47.8	47.6	48.1
	Baseline	38.6	48.6	51.6	57.2	43.4	47.9	46.9	14.8	42.1	57.4	43.4	40.9	18.2	59.1	57.3	50.1	41.5	45.2
	Baseline-FPN	41.8	68.4	61.7	66.8	45.8	56.9	52.7	16.3	46.8	58.1	44.9	43.8	**25.8**	50.2	**67.7**	47.7	47.8	47.8
	MPSR (ours)	48.3	**73.7**	**68.2**	**70.8**	**48.2**	**61.8**	51.8	**16.7**	**53.1**	66.4	**51.2**	**47.8**	24.4	55.8	67.5	**50.4**	**50.5**	**49.7**