Super Feature for Instance Segmentation

Team DIDIMapVison

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Team Members

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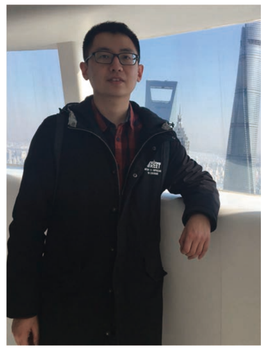
Yang Gu



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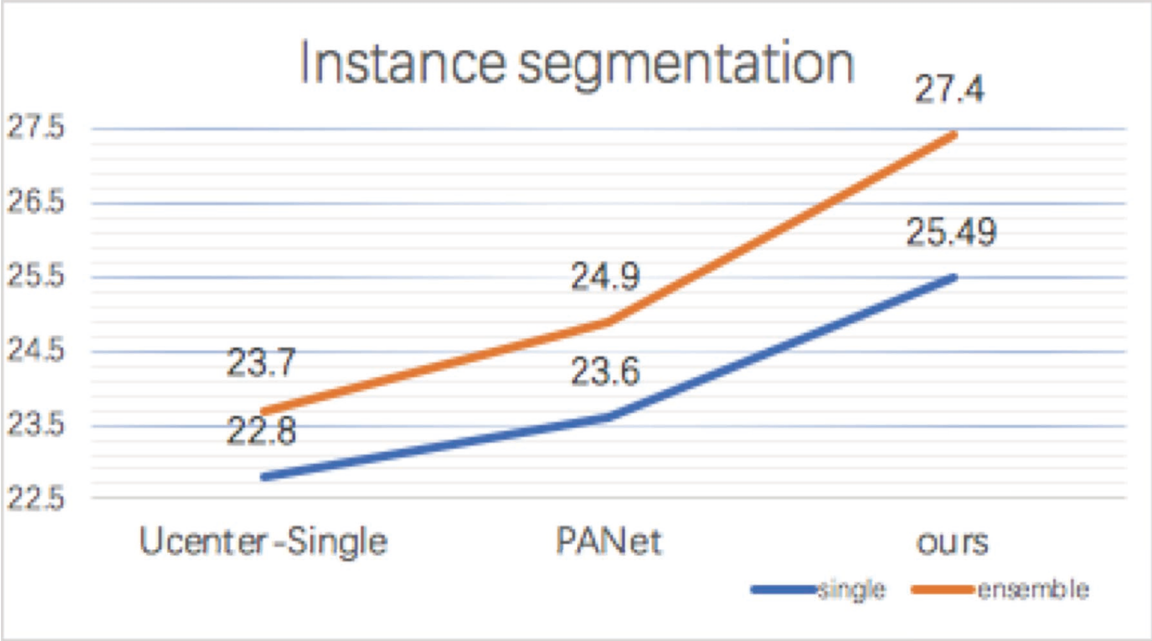
Summary

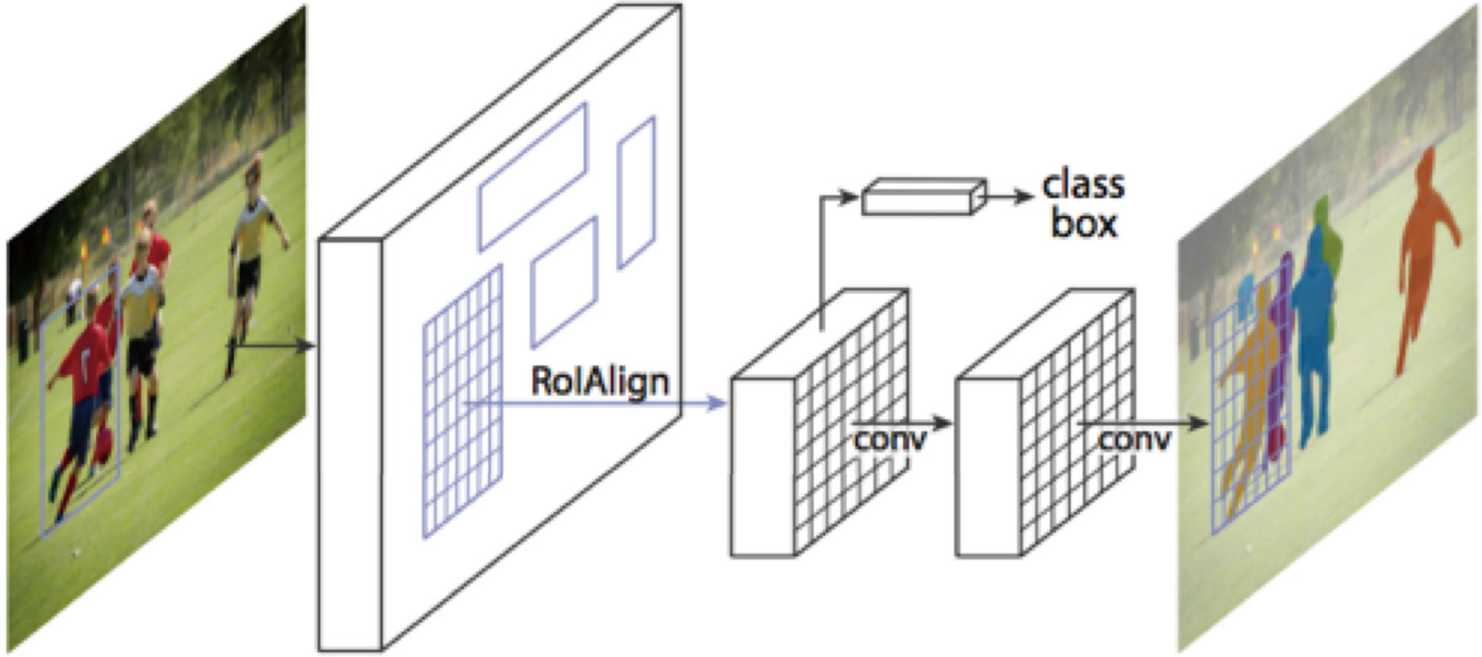
- Comparison



- Improvements
  - Instance Segmentation
    - 2.26% absolute and 8.9% relative improvement

Baseline Approach

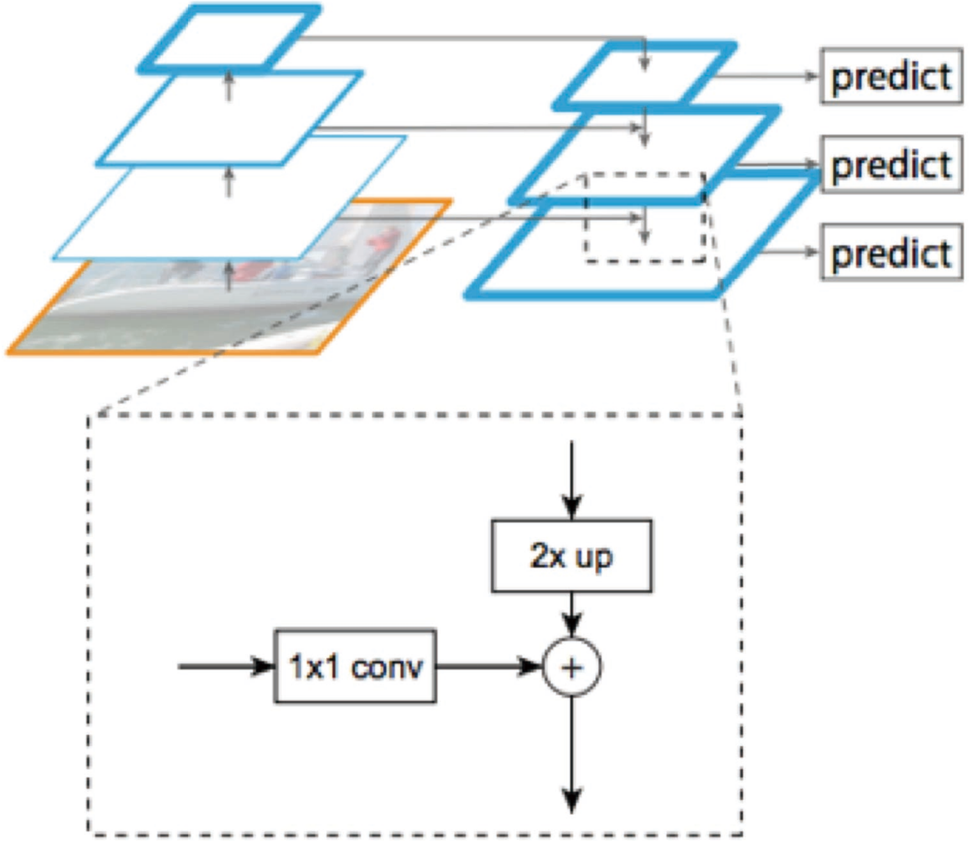
- Mask RCNN



K. He, G. Gkioxari, P. Dollár, and R. Girshick. Mask R-CNN. *ICCV*, 2017.

Baseline Approach

- FPN



T. Lin, P. Dollár, R. Girshick, K. He, B. Hariharan, and S. Belongie. Feature Pyramid Networks for Object Detection. *CVPR*, 2017.

How to involve rich features corresponded with original image size?

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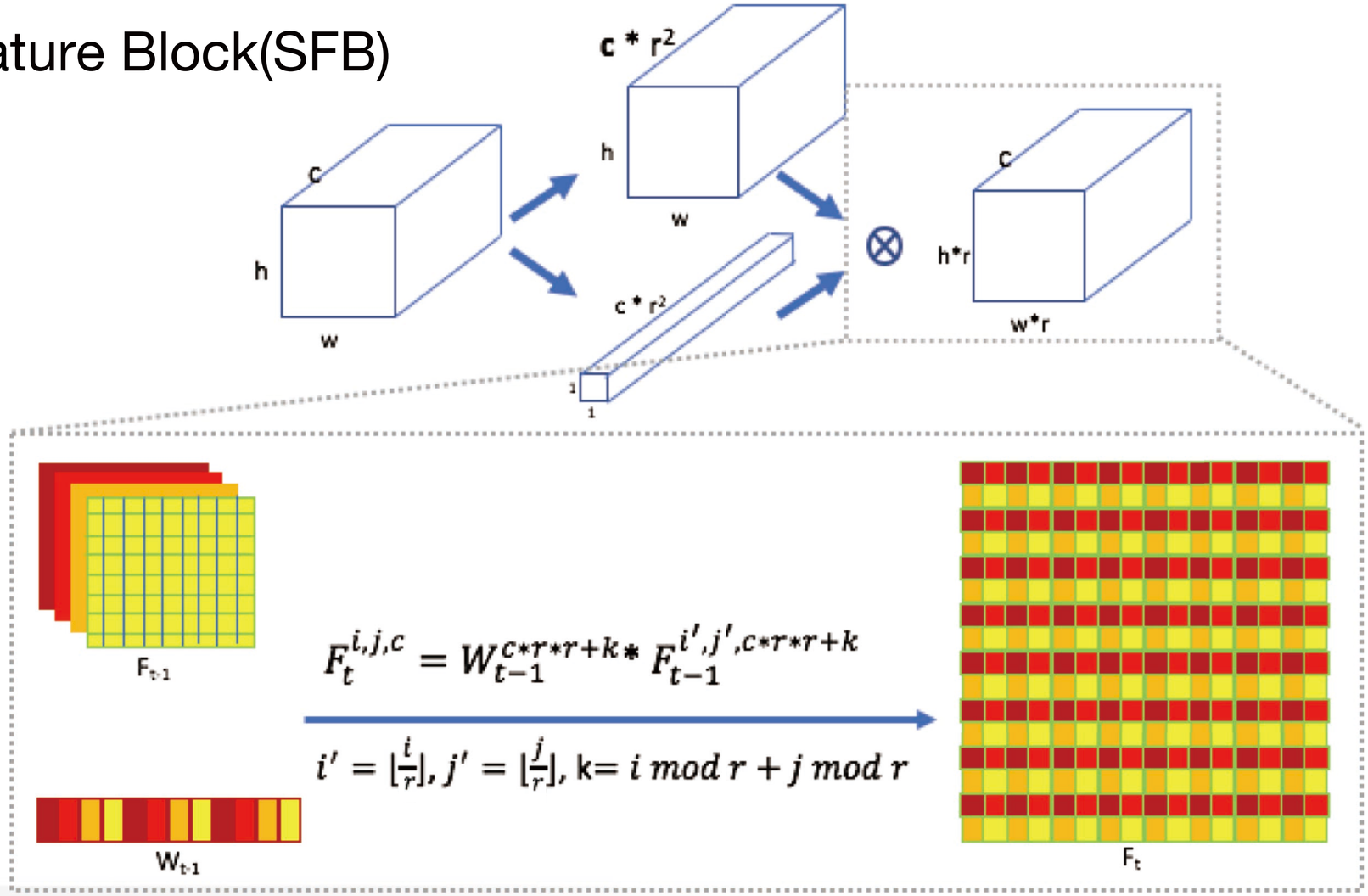
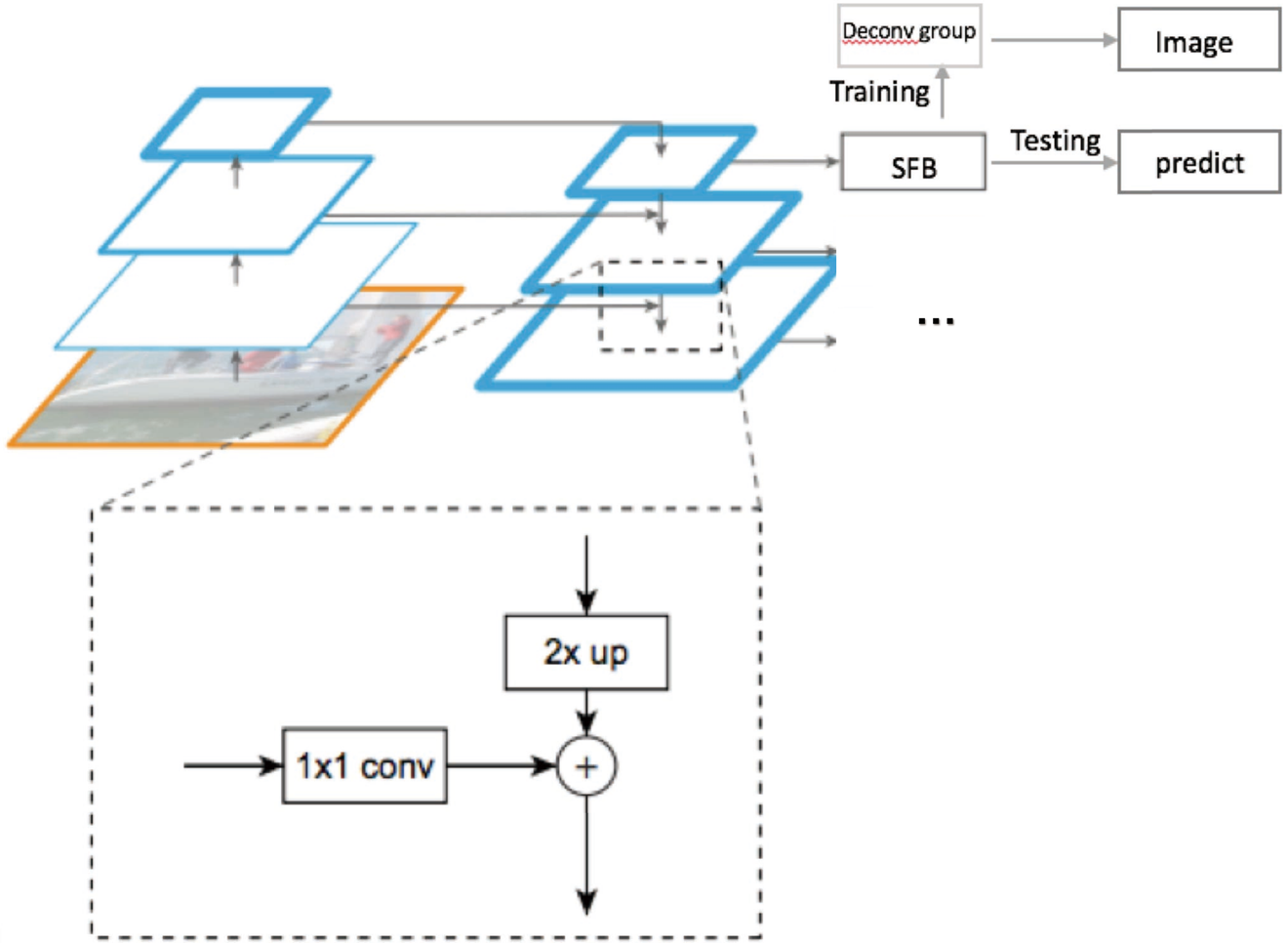
Super Feature Network

- Super Feature Block(SFB)



Super Feature Network

- FPN with SFB



Other Improvements

- Multi-scale training
- Additional dataset(COCO, Apolloscape)
- Path Aggregation Network(PANet)
- Deformable Convolutional Network(DCN)
- Data augmentation
- Heavier head
- Multi-scale and flip testing
- Mask voting
- Ensemble

Dai J, Qi H, Xiong Y, et al. Deformable convolutional networks[J]. CoRR, abs/1703.06211, 2017, 1(2): 3.

Liu, Shu, et al. "Path aggregation network for instance segmentation." *CVPR*，2018.

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Roadmap

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Roadmap

- Baseline
  Backbone: ResNet-101, ResNext-101, ResNext_152

- Memory and mAP

name	Max Size	Mask AP	BBox AP
ResNet-101	800 1333	9.11	11.0
	2400 3200	15.08	17.22
ResNext-101	800 1333	12.27	14.87
	1800 2400	16.46	19.07
ResNext-152	800 1333	13.7	16.43
	1500 2000	16.25	19.11

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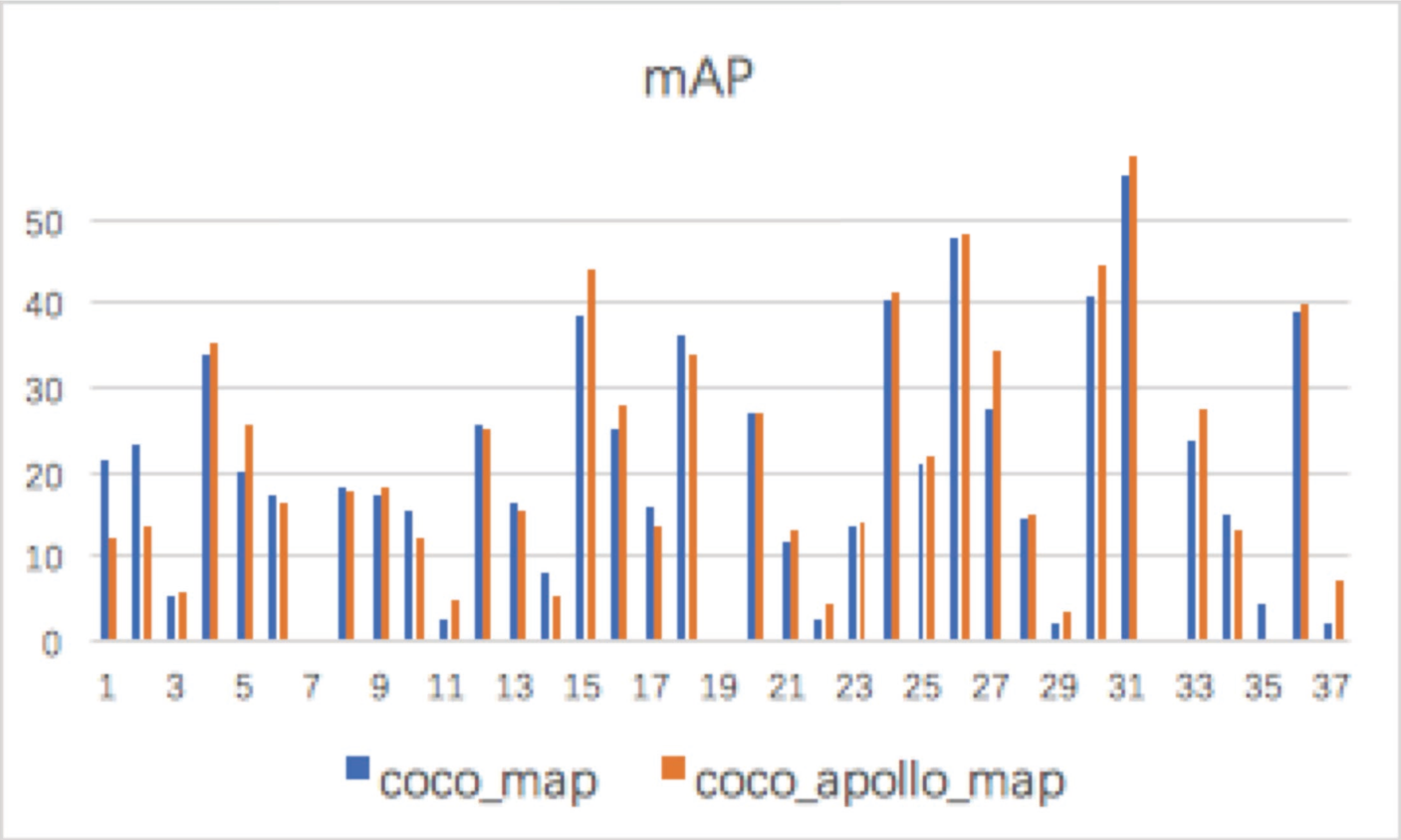
Roadmap

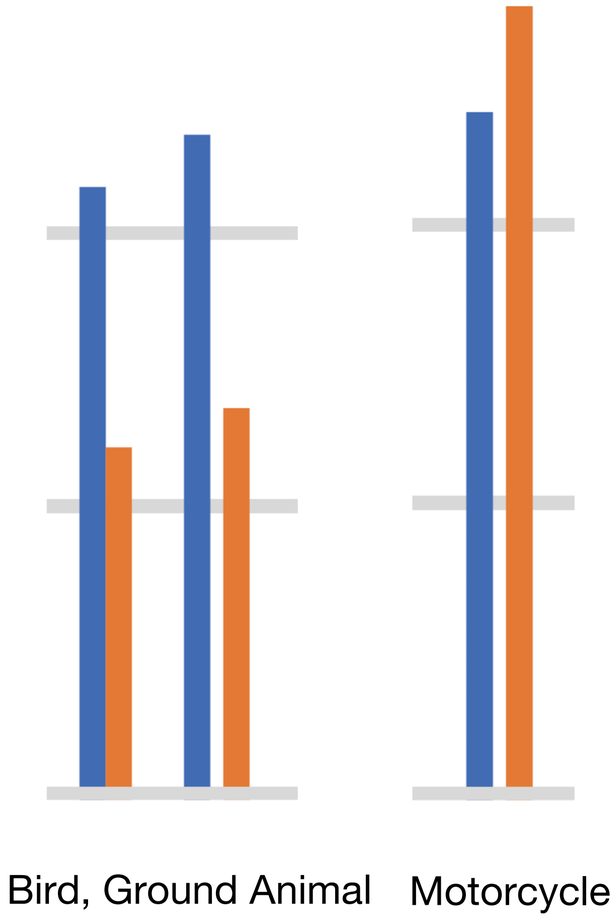
- ApolloScape
  8 classes: car, motorbicycle, bicycle, person, rider, truck, bus, tricycle
  width: 3387 height: 2710

Huang X, Cheng X, Geng Q, et al. The ApolloScape Dataset for Autonomous Driving[J]. arXiv preprint arXiv:1803.06184, 2018.

Roadmap

- mAP on models pretrained on different datasets.





Roadmap

- Additional Dataset
  - COCO
  - ApolloScape

name	Max Size	Mask AP	BBox AP
Baseline	1800 2400	16.46	19.07
+..	1800 2400	18.01	21.24
+pretrained on coco conv	1800 2400	19.6	23.6
+pretrained on coco full	1800 2400	19.74	24.03
+pretrained on coco_apollo_full	1800 2400	20.02	23.94

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Roadmap

- Multi Scale training
  - Shorter edge: [800, 933,1250,1400,1800]
  - Longer edge: 4000

name	Max Size	Mask AP	BBox AP
Baseline	1800 2400	16.46	19.07
+…	1800 2400	19.74	24.03
+multi scale	[800,933, 1250, 1400, 1800]	20.11	24.36

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Roadmap

- SFNet Improvement

name	Max Size	Maxk AP	BBox AP
Baseline	1800 2400	16.46	19.07
+…	[800,933, 1250, 1400, 1800]	20.11	24.36
+SFNet	[800,933, 1250, 1400, 1800]	23.25	27.92

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Roadmap

- Test tricks
  - Multi-scale testing
    - Shorter edge: [833,1400, 1800,2400,2800]
    - Longer edge: 4000
  - Horizontal flip
  - Mask voting
  - Heavier head & More anchors
  - Path Aggregation Network(PANet)
  - Deformable Convolution Network(DCN)
  - SoftNMS

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Roadmap

- Results

name	Max Size	Maxk AP	BBox AP
Baseline	1800 2400	16.46	19.07
+…	[800,933, 1250, 1400, 1800]	20.11	24.36
+SFNet	[800,933, 1250, 1400, 1800], r=2	23.25	27.92
+PANet	[800,933, 1250, 1400, 1800]	24.12	28.95
+DCN	[800,933, 1250, 1400, 1800]	24.51	29.20
+test tricks	Bbox vote, multi test, horizontal flip	25.49	30.67

Roadmap

- Ensemble(total 28 models)
  - Backbone: R101,X101(1000,1400,1800,2400)
  - Dataset: COCO, ApolloScape
  - PANet: mulit scales, multi settings
  - DCN: multi scales, multi settings
  - Mask-RCNN multi scale, multi settings
  - Sample balance: weighted loss, data augmentation
  - Class specific
  - Average/weighted(top k)

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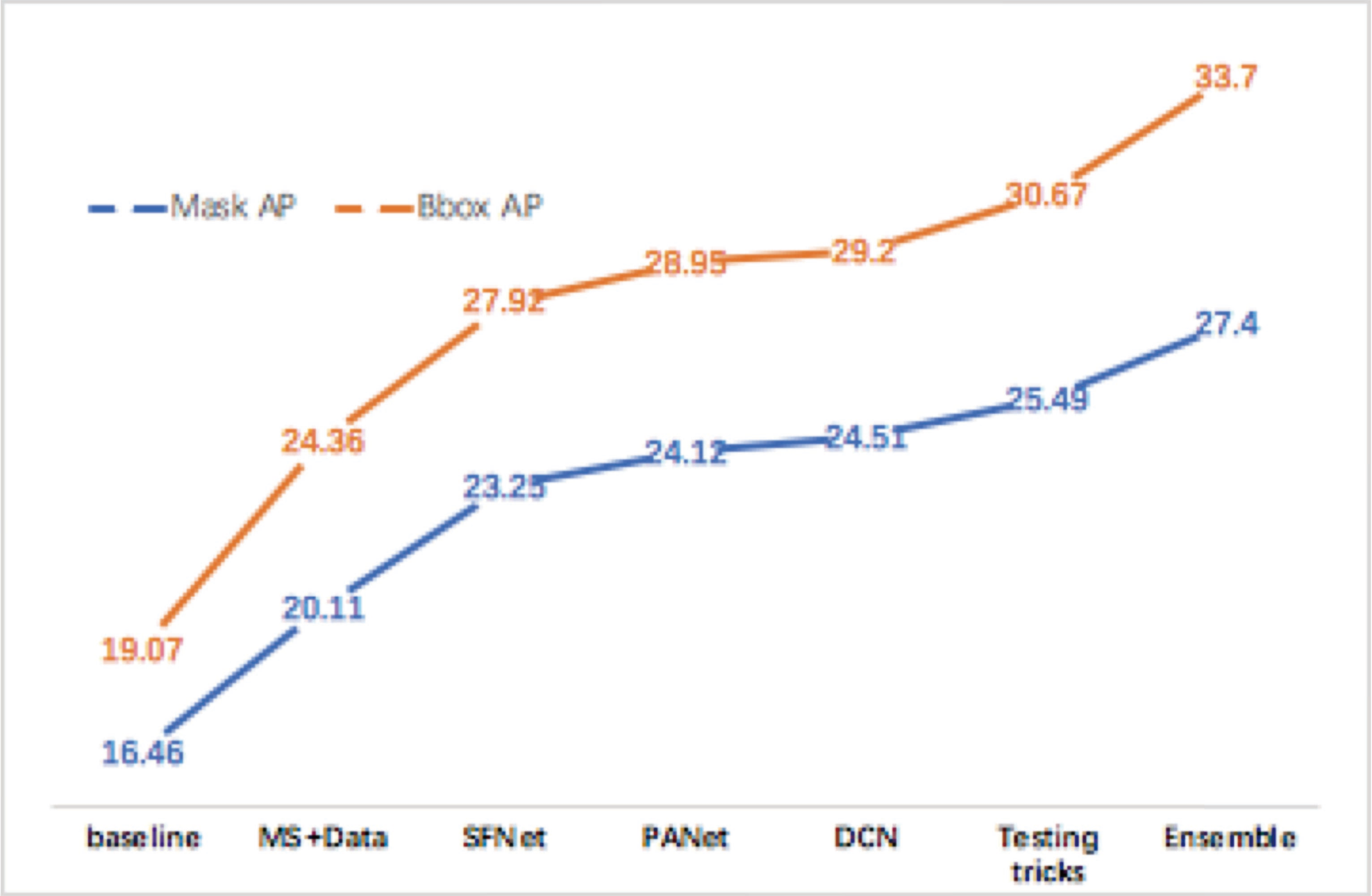
Roadmap

- Ensemble(total 28 models)

name	Max Size	Maxk AP	BBox AP
Baseline	1800 2400	16.46	19.07
+…	1800 2400	25.49	30.67
+model oriented ensemble	1800 2400	26.31	31.96
+average	1800 2400	26.97	32.82
+weighted top-k	1800 2400	27.4	33.7


Mask AP
Bbox AP
33.7
30.67
29.2
28.95
27.92
24.36
19.07
27.4
25.49
24.51
24.12
23.25
20.11
16.46
baseline
MS+Data
SFNet
PANet
DCN
Testing tricks
Ensemble

Visualizations

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Visualization

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Visualization

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Visualization

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Conclusion

- Training and Testing scale matters.
- Rich and realistic features is necessary.

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Thanks! Questions?

More details will be described in technical report!

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