

# Boundary-aware Graph Convolution for Semantic Segmentation



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## 1. Motivation

- Enhance the similarity of the same object.
- Keep the discrimination of other objects.
- Graph Convolution is good at passing information with the design of adjacency matrix and proves to be a good reasoning method.



## 2. Contributions

- We utilize a coarse-to-fine framework and obtain boundary prediction from coarse feature by learning it as one of the semantic categories with little increase on computation head.
- We propose the boundary-aware graph convolution module to enhance the feature similarity and keep discrimination from others.
- We achieve state-of-the-art results on three benchmark datasets.



#### 3. Methodology

#### 4. Experimental Results

- Ablation Studies
- Boundary-aware manner

Method	mIOU(%)
ResNet-101 Baseline ResNet-101 + plain GCN ResNet-101 + boundary-aware GCN	76.3 78.2 79.9

<ul> <li>BGC</li> </ul>	module
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Method	mIOU(%)
ResNet-101 Baseline	76.3
ResNet-101 + ASPP	78.4
ResNet-101 + BGC	79.9
ResNet-101 + ASPP + BGC	81.1

· Comparisons on test sets

#### Cityscapes

Method	Backbone	mIOU(%)
DeepLab-v2 [16]	ResNet-101	70.4
RefineNet [14]	ResNet-101	73.6
GCN [45]	ResNet-101	76.9
SAC [46]	ResNet-101	78.1
PSPNet [3]	ResNet-101	78.4
BiSeNet [47]	ResNet-101	78.9
AAF [48]	ResNet-101	79.1
DFN [49]	ResNet-101	79.3
PSANet [4]	ResNet-101	80.1
DenseASPP [42]	DenseNet-161	80.6
GloRe [22]	ResNet-101	80.9
DANet [43]	ResNet-101	81.5
BGCNet(Ours)	ResNet-101	82.1

## PASCAL VOC 2012

Method	Backbone	mIOU(%)
FCN [1]	VGG-16	62.2
DeepLab-CRF [16]	VGG-16	71.6
PSPNet [3]	ResNet-101	82.6
DFN [49]	ResNet-101	82.7
DANet [43]	ResNet-101	82.6
EncNet [50]	ResNet-101	82.9
BGCNet(Ours)	ResNet-101	<b>84.2</b>

#### COCO Stuff

Method	Backbone	mIOU(%)
FCN-8s [1] DAG-RNN [33] RefineNet [14] CCL [51] DSSPN [52] SCP [23]	VGG-16 VGG-16 ResNet-101 ResNet-101 ResNet-101 PesNet-101	22.7 31.2 33.6 35.7 37.3 39.1
BGCNet(Ours)	ResNet-101	<b>41.7</b>

- Visualizations
- Boundary learning

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Image	Original Groundtruth	Generated Groundtruth	Learned Boundary Map

Segmentation results

