

# Bidirectional Feature Pyramid Network with Recurrent Attention Residual Modules for Shadow Detection

Lei Zhu<sup>1,2,4,\*</sup>, Zijun Deng<sup>3,\*</sup>, Xiaowei Hu<sup>1</sup>, Chi-Wing Fu<sup>1,4</sup>, Xuemiao Xu<sup>3</sup>, Jing Qin<sup>2</sup>, and Pheng-Ann Heng<sup>1,4</sup>

<sup>1</sup>The Chinese University of Hong Kong, <sup>2</sup>The Hong Kong Polytechnic University, <sup>3</sup>South China University of Technology, <sup>4</sup>Shenzhen Institutes of Advanced Technology, CAS

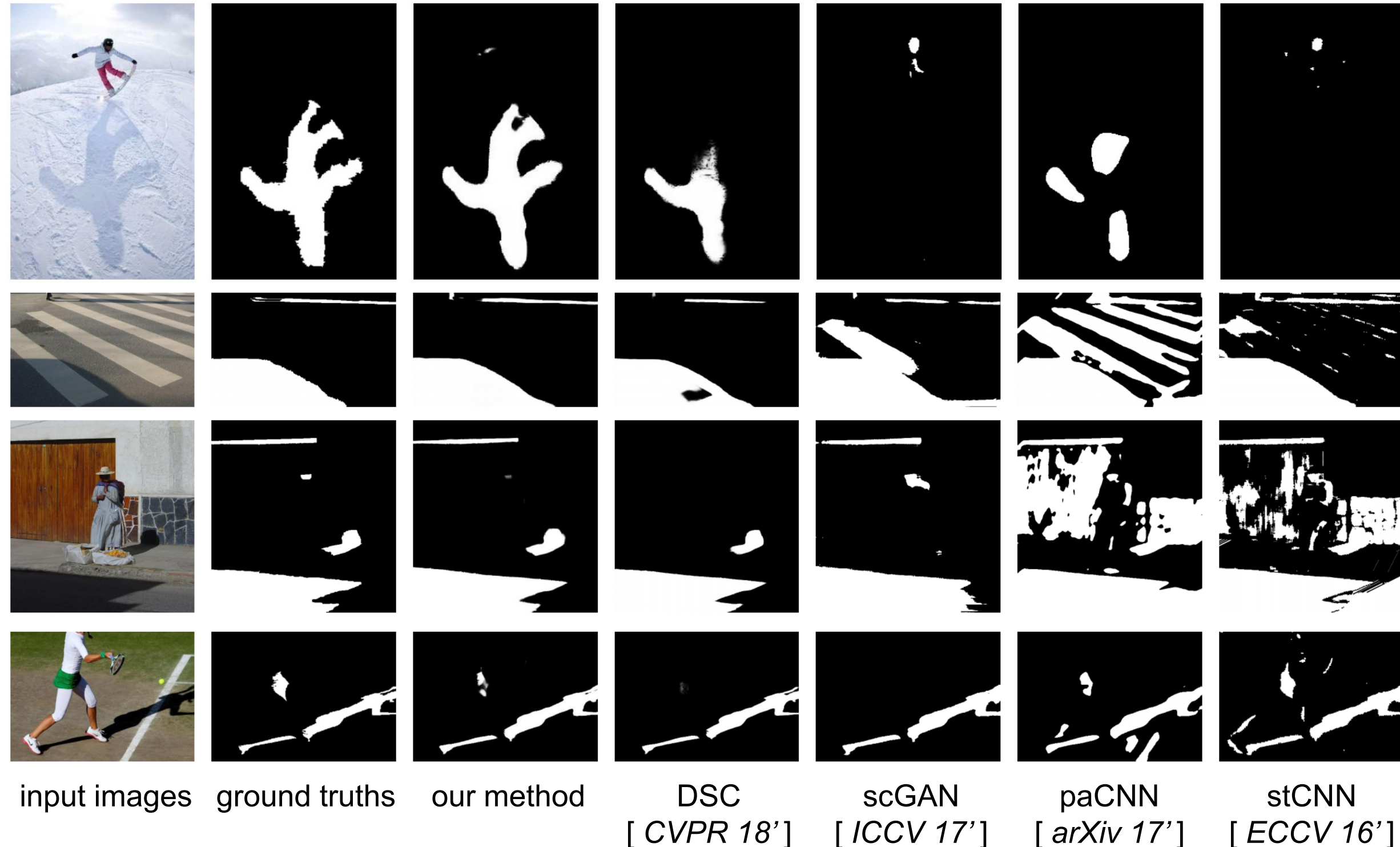


## Contributions

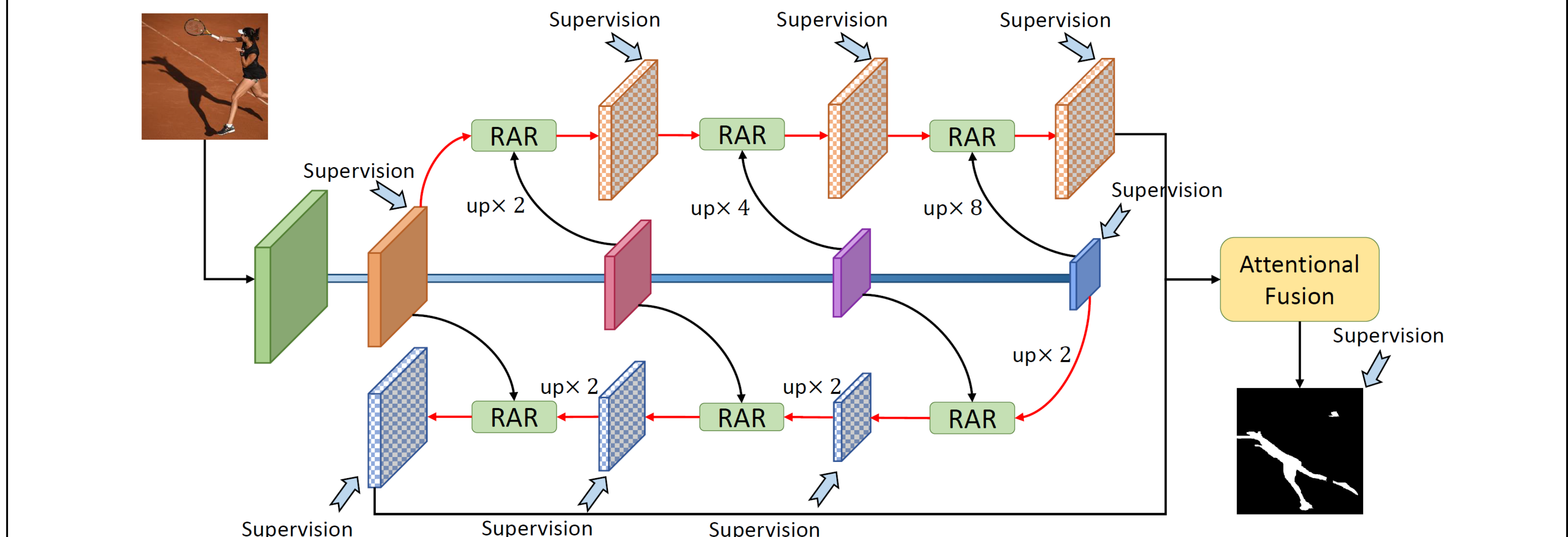
- Detect shadows by exploring and combining **global context in deep layers** and **local context in shallow layers** of a deep convolutional neural network (CNN).
- Formulate the **recurrent attention residual (RAR) module** to combine the contexts in two adjacent CNN layers and learn an attention map to select a residual and then refine the context features.
- Develop a **bidirectional feature pyramid network** (BFPN) to aggregate shadow contexts spanned across different CNN layers by deploying two series of RAR modules.
- Outperform the best existing method with **34.88%** reduction on SBU and **34.57%** reduction on UCF for the balance error rate (BER).

## Experimental Results

method	BER	
	SBU	UCF
<b>BDRAR (ours)</b>	<b>3.64</b>	<b>5.30</b>
DSC	5.59	8.10
scGAN	9.10	11.50
stacked-CNN	11.00	13.00
patched-CNN	11.56	-
Unary-Pairwise	25.03	-
DeshadowNet	6.96	8.92
SRM	7.25	9.81
Amulet	15.13	15.17
PSPNet	8.57	11.75



## Network Architecture



## Module Details

