

# Salient Objects in Clutter: Bringing Salient Object Detection to the Foreground

## Supplementary Material

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### 1 Contents

In this document, we include additional material related to our SOC dataset and the evaluation.

- **Dataset.** In Fig. 1 and Fig. 2, we visualize some representative salient image with instance ground-truth masks overlayed in different color, with specific categories. For images with non-salient object, we showed in Fig. 3. We refer the reader to the accompanying video (salient.mp4, non-salient.mp4) for a complete visualization of SOC dataset. A summary of a comprehensive and balanced dataset requirements detailed in Section 3 (*manuscript*) can be found in Table 1.

No	Dataset	Year	Pub	HQ	SIZE	Non-Sal	ATTR	CATEG	BB	PW	IL
1	MSRA-A, -B [1]	2007	CVPR	✓	✓				✓		
2	SED2 [2]	2007	CVPR	✓						✓	
3	ASD [3]	2009	CVPR	✓						✓	
4	SOD [4]	2010	CVPRW	✓						✓	
5	Judd-A [5]	2012	ECCV	✓						✓	
6	DUT-OMRON [6]	2013	CVPR	✓	✓				✓	✓	
7	ECSSD [7]	2013	CVPR	✓						✓	
8	PASCAL-S [8]	2014	CVPR	✓						✓	
9	HKU-IS [9]	2015	CVPR	✓						✓	
10	XPIE [10]	2017	CVPR	✓	✓					✓	
11	DUTS [11]	2017	CVPR	✓	✓					✓	
12	ILSO [12]	2017	CVPR	✓						✓	✓
13	JOT [13]	2017	FCS	✓	✓	✓				✓	
14	OURS			✓	✓	✓	✓	✓	✓	✓	✓

**Table 1. Current salient object detection datasets comparison.** From left to right: high quality annotation for dataset (**HQ**), large ( $\geq 5k$ ) overall size of the dataset (**SIZE**), contain images with non-salient object (**Non-Sal**), salient objects with attributes (**ATTR**), salient objects with categories (**CATEG**), salient objects annotated with bounding boxes (**BB**), salient objects labeled with pixel-wise (**PW**), salient objects labeled with instance-level (**IL**). A detailed overview of the requirements is described in Section 3 (*manuscript*). Our dataset is the only one meeting all requirements.

- **Attributes.** In Table 2, we summarize the attributes assigned to each image with salient objects. We refer the reader to Table 2 (*manuscript*) for a comprehensive description of the attributes.

Attr	Single-task												Multi-task			
	LEGS	MC	MDF	DCL	AMU	RFCN	DHS	ELD	DISC	IMC	UCF	DSS	NLDF	DS	WSS	MSR
	[14]	[15]	[9]	[16]	[16]	[17]	[18]	[19]	[20]	[21]	[22]	[23]	[24]	[25]	[11]	[12]
$S_{sal}$	.607	.619	.610	.705	.705	.709	<b>.728</b>	.664	.629	.679	.678	.698	.714	.719	.676	<b>.748</b>
<b>AC</b>	.625	.631	.614	.734	.736	.744	<b>.745</b>	.673	.644	.702	.714	.726	.737	.764	.691	<b>.789</b>
%	↑3.0	↑1.9	↑0.7	↑4.1	↑4.4	↑4.9	↑2.3	↑1.4	↑2.4	↑3.4	↑5.3	↑4.0	↑3.2	↑6.3	↑2.2	↑5.5
<b>BO</b>	.509	.490	.461	.610	.569	.540	.590	.576	.517	<b>.701</b>	.636	.496	.568	.685	.566	.667
%	↓16.1	↓20.8	↓24.4	↓13.5	↓19.3	↓23.8	↓19	↓13.3	↓17.8	↑3.2	↓6.2	↓28.9	↓20.4	↓4.7	↓16.3	↑5.5
<b>CL</b>	.620	.635	.566	.699	.708	.714	<b>.743</b>	.658	.635	.696	.704	.677	.713	.729	.678	<b>.756</b>
%	↑2.1	↑2.6	↓7.2	↓0.9	↑0.4	↑0.7	↑2.1	↓0.9	↑1.0	↑2.5	↑3.8	↓3.0	↓0.1	↑1.4	↑0.3	↑1.1
<b>HO</b>	.666	.666	.648	.745	.755	.759	<b>.766</b>	.706	.681	.715	.744	.748	.755	.756	.707	<b>.777</b>
%	↑9.7	↑7.6	↑6.2	↑5.7	↑7.1	↑7.1	↑5.2	↑6.3	↑8.3	↑5.3	↑9.7	↑7.2	↑5.7	↑5.1	↑4.6	↑3.9
<b>MB</b>	.543	.603	.615	.693	.706	.715	<b>.722</b>	.639	.600	.689	.682	.695	.685	.711	.641	<b>.757</b>
%	↓10.5	↓2.6	↑0.8	↓1.7	↑0.1	↑0.8	↓0.8	↓3.8	↓4.6	↑1.5	↑0.6	↓0.4	↓4.1	↓1.1	↓5.2	↑1.2
<b>OC</b>	.609	.617	.608	.708	<b>.725</b>	.711	.716	.658	.630	.672	.701	.689	.709	.725	.672	<b>.740</b>
%	↑0.3	↓0.3	↓0.3	↑0.4	↑2.8	↑0.3	↑1.6	↓0.9	↑0.2	↓1.0	↓3.4	↓1.3	↓0.7	↑0.8	↓0.6	↓1.1
<b>OV</b>	.548	.584	.568	.699	<b>.708</b>	.687	.706	.637	.573	.693	.685	.665	.688	.722	.624	<b>.743</b>
%	↓9.7	↓5.7	↓6.9	↓0.9	↑0.4	↓3.1	↓3.0	↓4.1	↓8.9	↑2.1	↑1.0	↓4.7	↓3.6	↑0.4	↓7.7	↓0.7
<b>SC</b>	.608	.620	.669	.738	.731	.735	<b>.763</b>	.688	.653	.690	.722	.746	.745	.724	.677	<b>.773</b>
%	↑0.2	↑0.2	↑9.7	↑4.7	↑3.7	↑3.7	↑4.8	↑3.6	↑3.8	↑1.6	↑6.5	↑6.9	↑4.3	↑0.7	↑0.1	↑3.3
<b>SO</b>	.573	.601	.621	.691	.685	.698	<b>.713</b>	.644	.614	.648	.650	.696	.703	.696	.659	<b>.730</b>
%	↓5.6	↓2.9	↑1.8	↓2.0	↓2.8	↓1.6	↓2.1	↓3.0	↓2.4	↓4.6	↓4.1	↓0.3	↓1.5	↓3.2	↓2.5	↓2.4

**Table 2. Attributes-based performance on our SOC salient objects sub-dataset.** For each model, the score corresponds to the average structure similarity  $M_S$  (Section 3.1 in *manuscript*) over all datasets with that specific attribute (e.g., CL). The higher the score the better the performance. The best performance is highlighted in **bold**. The average salient-object performance  $S_{sal}$  is presented in the first row using the structure similarity  $S$ . The symbol of ↑ and ↓ indicates the proportion of increase and decrease compare to the  $S_{sal}$  result, respectively.

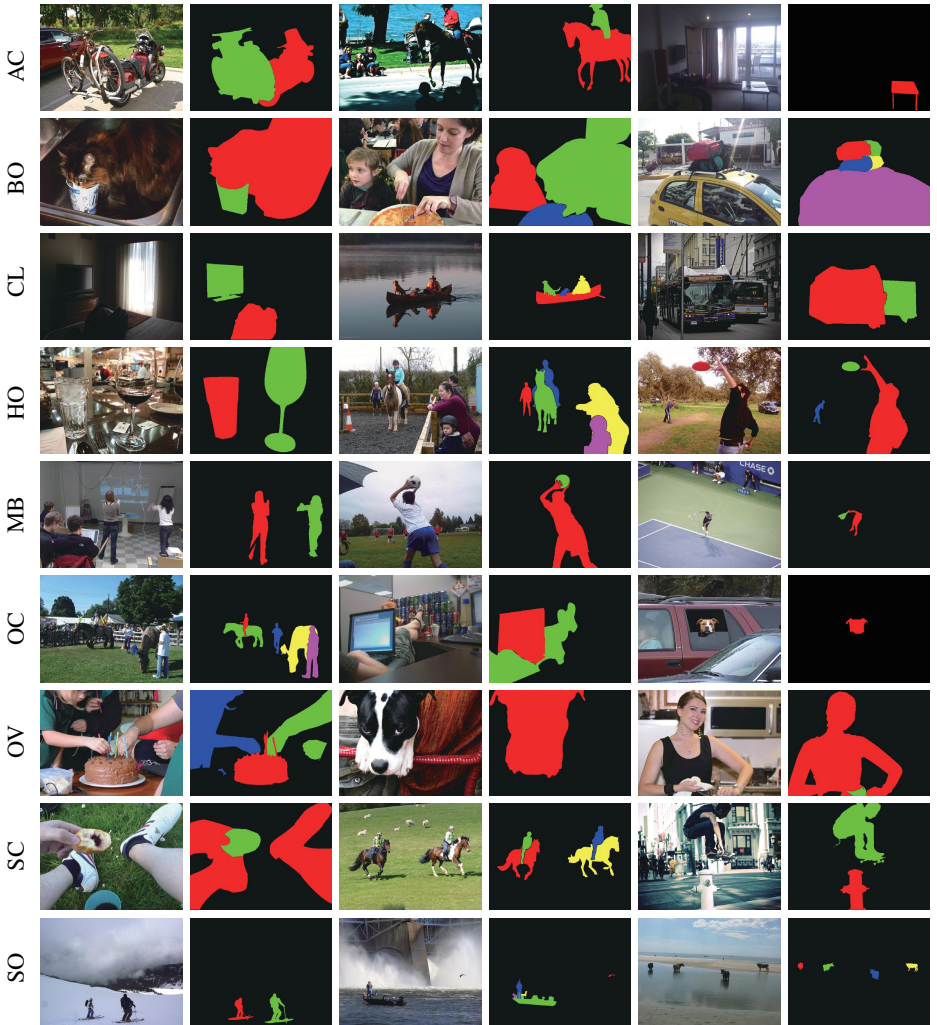
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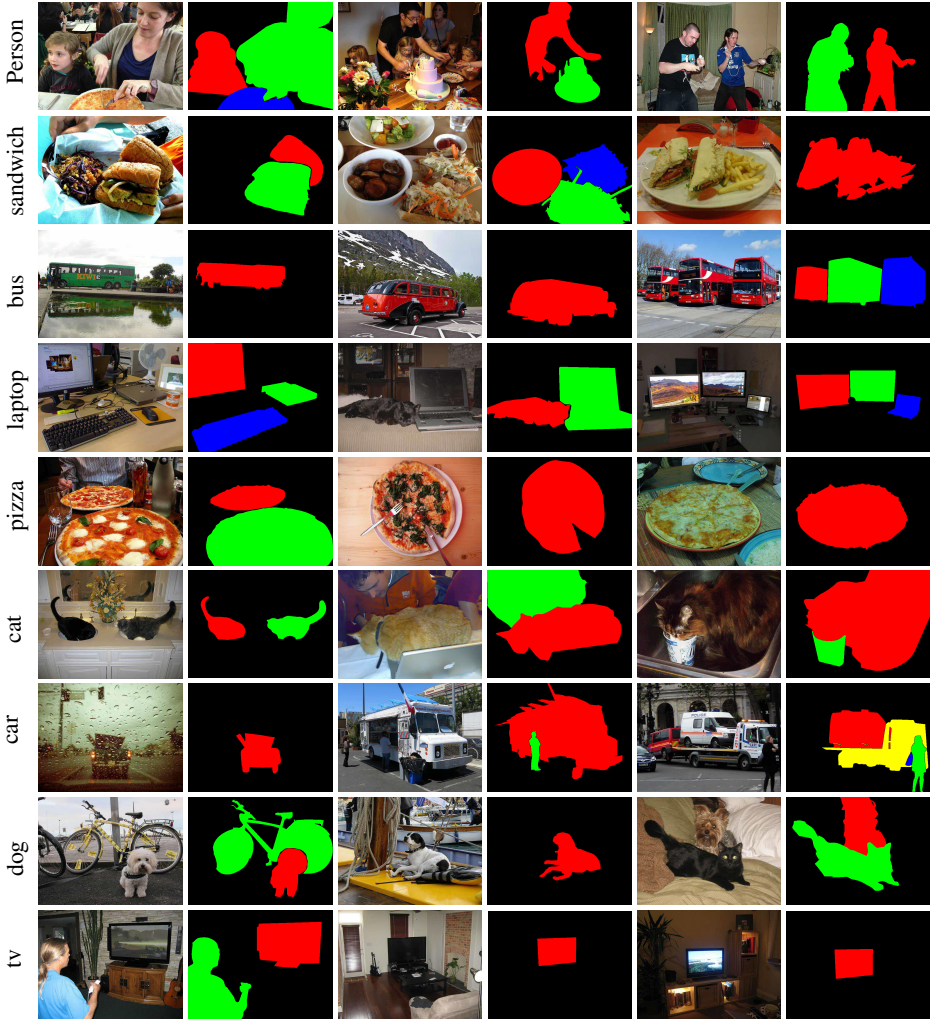
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Image	AC	BO	CL	HO	MB	OC	OV	SC	SO
COCO_train2014_000000000089.jpg				✓					
COCO_train2014_000000000110.jpg		✓		✓	✓				
COCO_train2014_000000000307.jpg				✓					✓
COCO_train2014_000000000321.jpg				✓					
COCO_train2014_000000000332.jpg		✓		✓					
COCO_train2014_000000000349.jpg				✓					
COCO_train2014_000000000382.jpg								✓	✓
COCO_train2014_000000000389.jpg				✓					
COCO_train2014_000000000419.jpg				✓					✓
COCO_train2014_000000000443.jpg									
COCO_train2014_000000000450.jpg		✓		✓					
COCO_train2014_000000000510.jpg				✓					✓
COCO_train2014_000000000531.jpg				✓				✓	✓
COCO_train2014_000000000605.jpg									
COCO_train2014_000000000716.jpg	✓		✓	✓					✓
COCO_train2014_000000000731.jpg				✓					
COCO_train2014_000000000853.jpg		✓		✓					
COCO_train2014_000000001144.jpg	✓			✓					
COCO_train2014_000000001145.jpg									
COCO_train2014_000000001261.jpg				✓					
COCO_train2014_000000001386.jpg				✓			✓		✓
COCO_train2014_000000001403.jpg	✓			✓					
COCO_train2014_000000001424.jpg				✓	✓				
COCO_train2014_000000001510.jpg	✓			✓				✓	
COCO_train2014_000000001518.jpg				✓					✓
COCO_train2014_000000001523.jpg	✓			✓					
COCO_train2014_000000001536.jpg				✓					
COCO_train2014_000000001670.jpg				✓				✓	✓
COCO_train2014_000000001804.jpg		✓						✓	
COCO_train2014_000000001926.jpg				✓					
COCO_train2014_000000001958.jpg				✓	✓				
COCO_train2014_000000001966.jpg				✓				✓	✓
COCO_train2014_000000001994.jpg	✓		✓	✓			✓		
COCO_train2014_000000002007.jpg				✓				✓	✓
COCO_train2014_000000002258.jpg	✓							✓	
COCO_train2014_000000002281.jpg				✓		✓	✓		
COCO_train2014_000000002347.jpg	✓		✓	✓					
COCO_train2014_000000002754.jpg				✓		✓		✓	✓
COCO_train2014_000000002860.jpg				✓				✓	
COCO_train2014_000000003366.jpg	✓			✓				✓	
COCO_train2014_000000003535.jpg	✓			✓					✓
COCO_train2014_000000003671.jpg			✓	✓					
COCO_train2014_000000003713.jpg				✓				✓	✓
COCO_train2014_000000003860.jpg	✓			✓				✓	✓

**Table 3. List of attributes for each image in our SOC dataset.** Left to right: Appearance Change (AC), Big Object (BO), Clutter (CL), Heterogeneous Object(HO), Motion Blur (MB), Occlusion (OC), Out-of-View (OV), Shape Complexity (SC), Small Object (SO). Please see the Table 2 (*manuscript*) for the description of each attribute. Some example can be found in Fig. 1. The complete attributes file can be found in the attribute folder.



**Fig. 1. Sample salient images annotated with attributes from our SOC dataset.** Please refer to the accompanying attribute folder for a complete attribute information.



**Fig. 2. Some categories of images containing instance-level salient objects from our SOC dataset.** Please refer to the accompanying video of salient.mp4 (video has been compressed) for a complete visualization of the dataset.





**Fig. 3. Sample images without salient objects from our SOC dataset.** Please refer to the accompanying video of non-salient.mp4 (video has been compressed) for a complete visualization of the dataset.