Instance-Level Salient Object Segmentation

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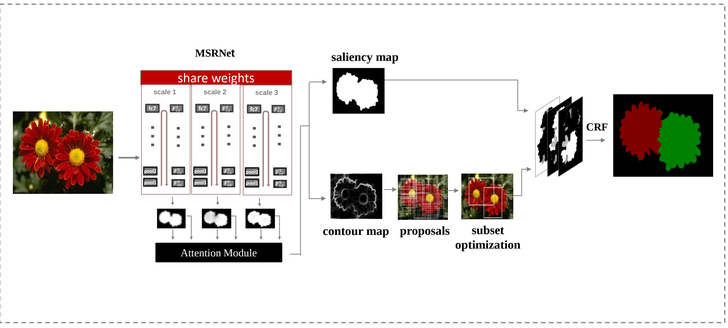
Overview

Instance level salient object segmentation pipeline:

1. Multiscale refinement network for saliency map estimation and salient object contour detection.
2. Salient object proposal generation and screening.
3. Refinement of salient instance segmentation based on CRF.

Contributions:

- Develop a fully convolutional multiscale refinement network, called MSRNet, for salient region detection.
- MSRNet generalizes well to salient object contour detection, making it possible to separate object instances in detected salient regions
- A new challenging dataset for salient instance segmentation.

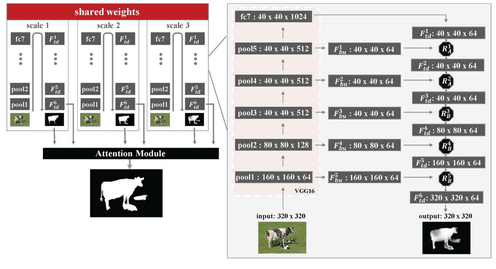


Multiscale Refinement Network

Three refined VGG network streams with shared parameters and a learned attentional model for fusing results at different scales.

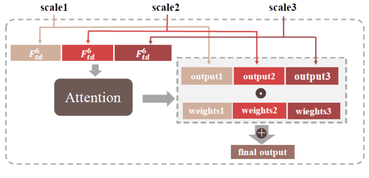
Refined VGG Network

- Transform the original VGG16 into a fully convolutional network, which serves as our bottom-up **backbone network**.
- Augment the backbone network with **a top-down refinement stream**.
- The refinement stream consists of five stacked refinement modules.



Refinement Module: R

- To invert the effect of each pooling layer and double the resolution if necessary.
- First concatenating F_{td}^{i} and F_{bu}^{i}, then feeding them to another 3×3 convolutional layer with 64 channels.



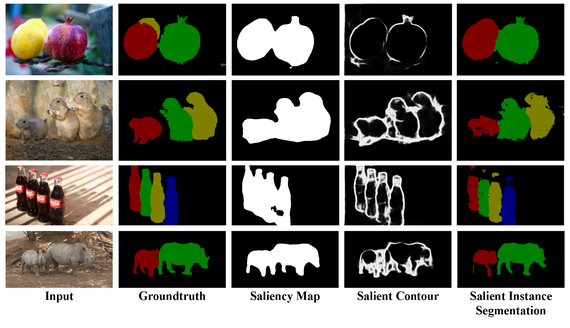
Multiscale Fusion with Attentional Weights

$$F_c = \Sigma_{s\in\{1,0.75,0.5\}} W^s \odot M_c^s$$

Experiments

Evaluation on Salient Instance Segmentation

For salient object contour detection: ODS, OIS, AP
For salient instance segmentation: mAP^r



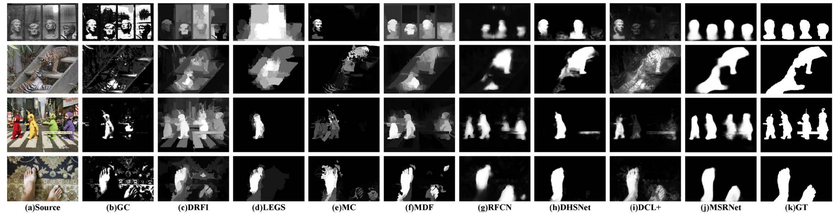
Examples of salient instance segmentation results by our MSRNet based framework.

Salient Contour Detection			Salient Instance Segmentation	
ODS	OIS	AP	mAP^r@0.5(%)	mAP^r@0.7(%)
0.719	0.757	0.765	65.32	52.18

Quantitative benchmark of our new dataset.

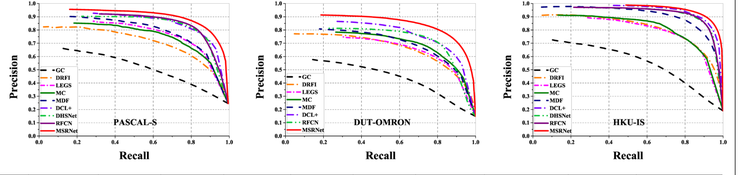
Experiments

Evaluation on Salient Region Detection:



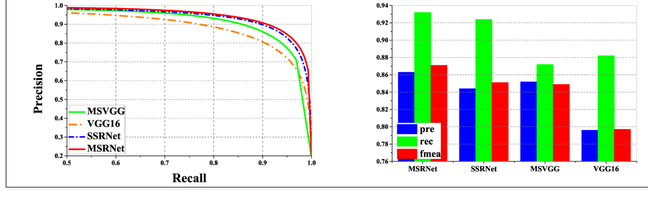
Visual comparison of saliency maps from state-of-the-art methods, including our MSRNet. MSRNet consistently produces saliency maps closest to the ground truth.

precision-recall



Dataset	Metric	GC	DRFI	LEGS	MC	MDF	RFCN	DHSNet	DCL+	MSRNet
MSRA-B	maxF	0.719	0.845	0.870	**0.894**	0.885	—	—	**0.916**	**0.930**
	MAE	0.159	0.112	0.081	**0.054**	0.066	—	—	**0.047**	**0.042**
PASCAL-S	maxF	0.539	0.690	0.752	0.740	0.764	**0.832**	**0.824**	0.822	**0.852**
	MAE	0.266	0.210	0.157	0.145	0.145	0.118	**0.094**	**0.108**	**0.081**
DUT-OMRON	maxF	0.495	0.664	0.669	0.703	0.694	**0.747**	—	**0.757**	**0.785**
	MAE	0.218	0.150	0.133	**0.088**	0.092	0.095	—	**0.080**	**0.069**
HKU-IS	maxF	0.588	0.776	0.770	0.798	0.861	**0.896**	0.892	**0.904**	**0.916**
	MAE	0.211	0.167	0.118	0.102	0.076	0.073	**0.052**	**0.049**	**0.039**
ECSSD	maxF	0.597	0.782	0.827	0.837	0.847	0.899	**0.907**	**0.901**	**0.913**
	MAE	0.233	0.170	0.118	0.100	0.106	0.091	**0.059**	**0.068**	**0.054**
SOD	maxF	0.526	0.699	0.732	0.727	0.785	0.805	**0.823**	**0.832**	**0.847**
	MAE	0.284	0.223	0.195	0.179	0.155	0.161	**0.127**	**0.126**	**0.112**

Effectiveness of Multiscale Refinement Network



Scan here!