Tsinghua University

FEDER: Camouflaged Object Detection with Feature Decomposition and Edge Reconstruction

Chunming He

Outline

- Abstract
- Challenge
- Methodology
- Experiments

清華大學
Tsinghua University

01

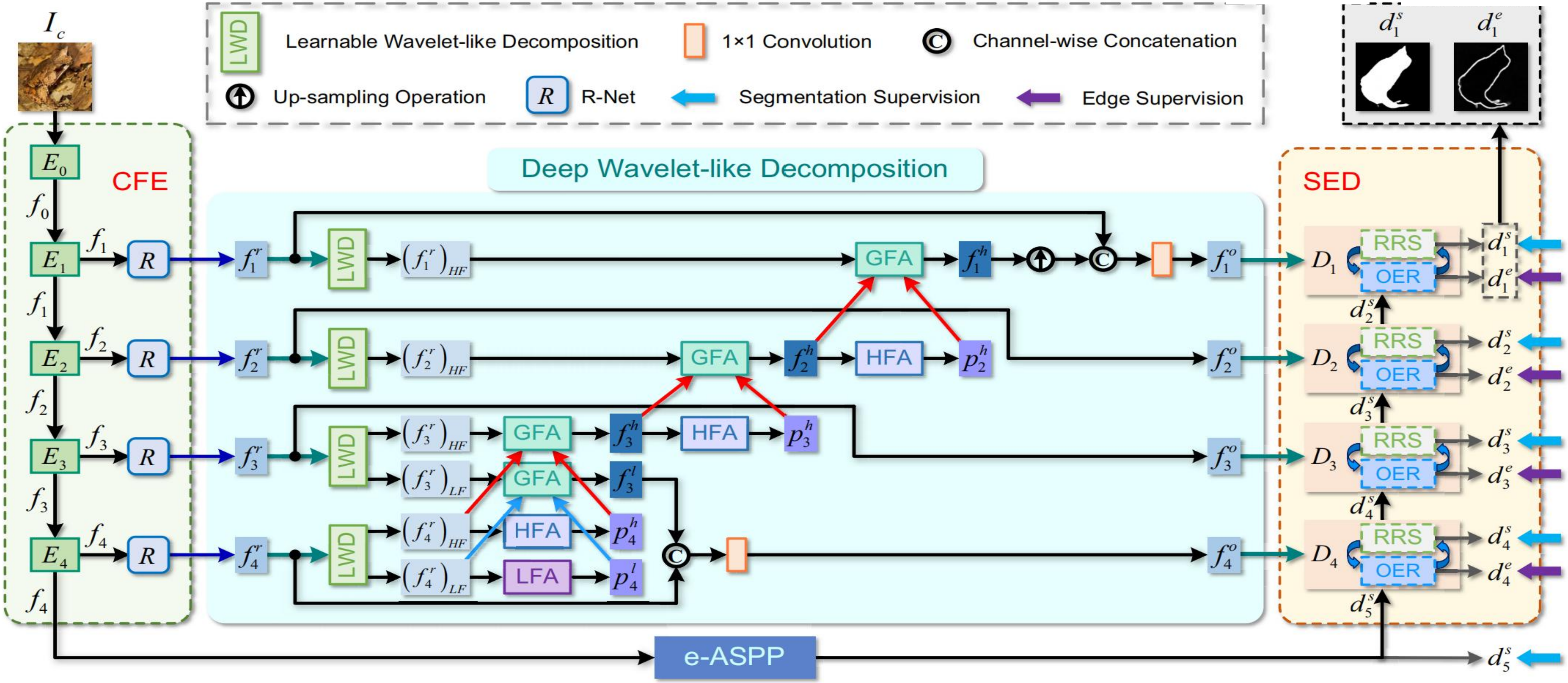
Abstract

Tsinghua University

FEDER: Camouflaged Object Detection with Feature Decomposition and Edge Reconstruction

Code

Wechat

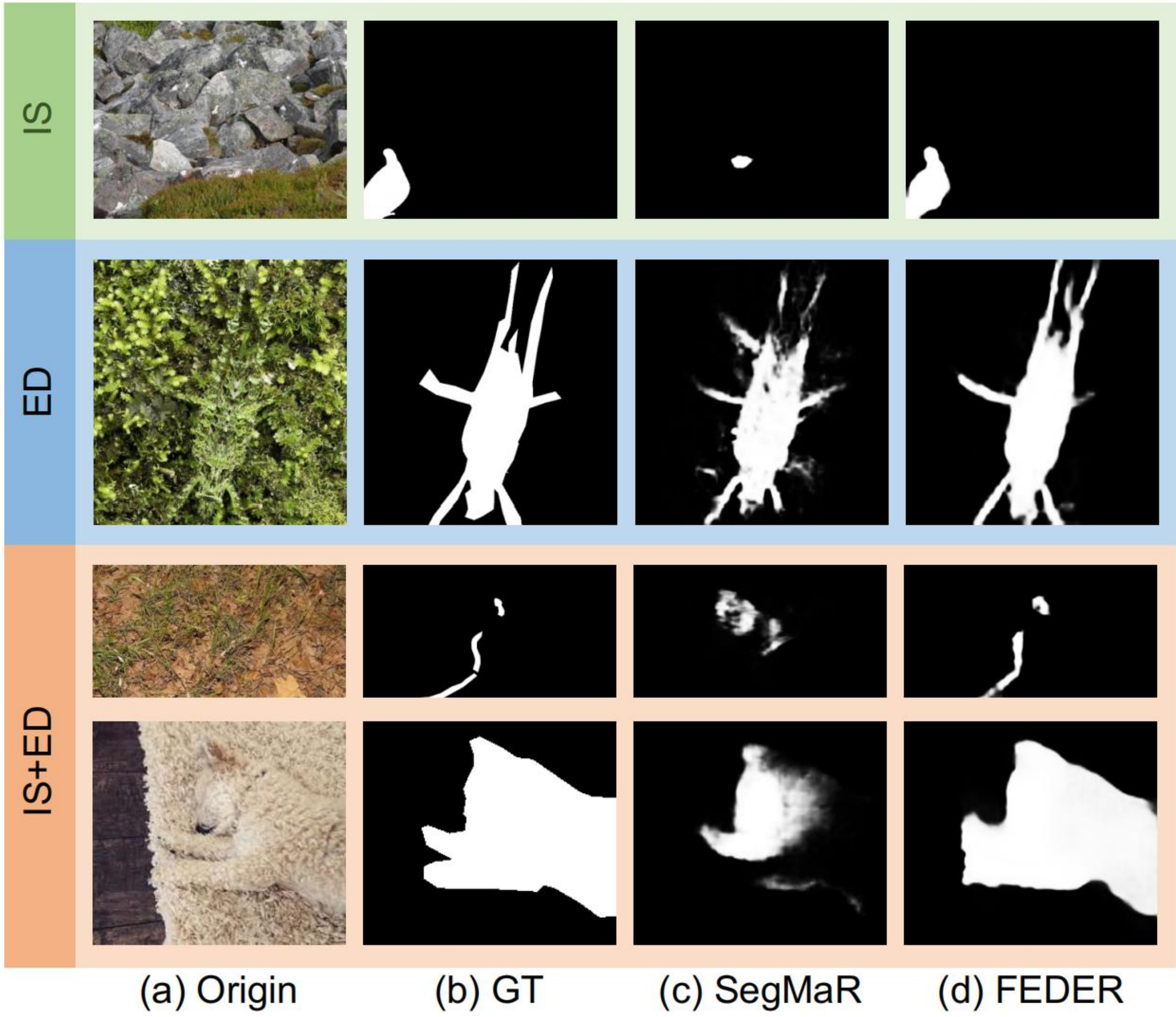


清華大学
Tsinghua University

02

Challenge

FEDER: Camouflaged Object Detection with Feature Decomposition and Edge Reconstruction



Two challenges:

Intrinsic Similarity (IS) and Edge Disruption (ED).

Scenarios:

For instance, as illustrated in the left figure, the state-of-the-art human perception-based COD method can only generate inaccurate prediction maps, such as the vague caddisfly and incomplete dog (Row 2 and 4), or even fail to detect camouflaged objects like the bird and snake (Row 1 and 3). Therefore, a better COD method should compensate for the "flaw" in human perception by emphasizing subtle discriminative features.

清華大學

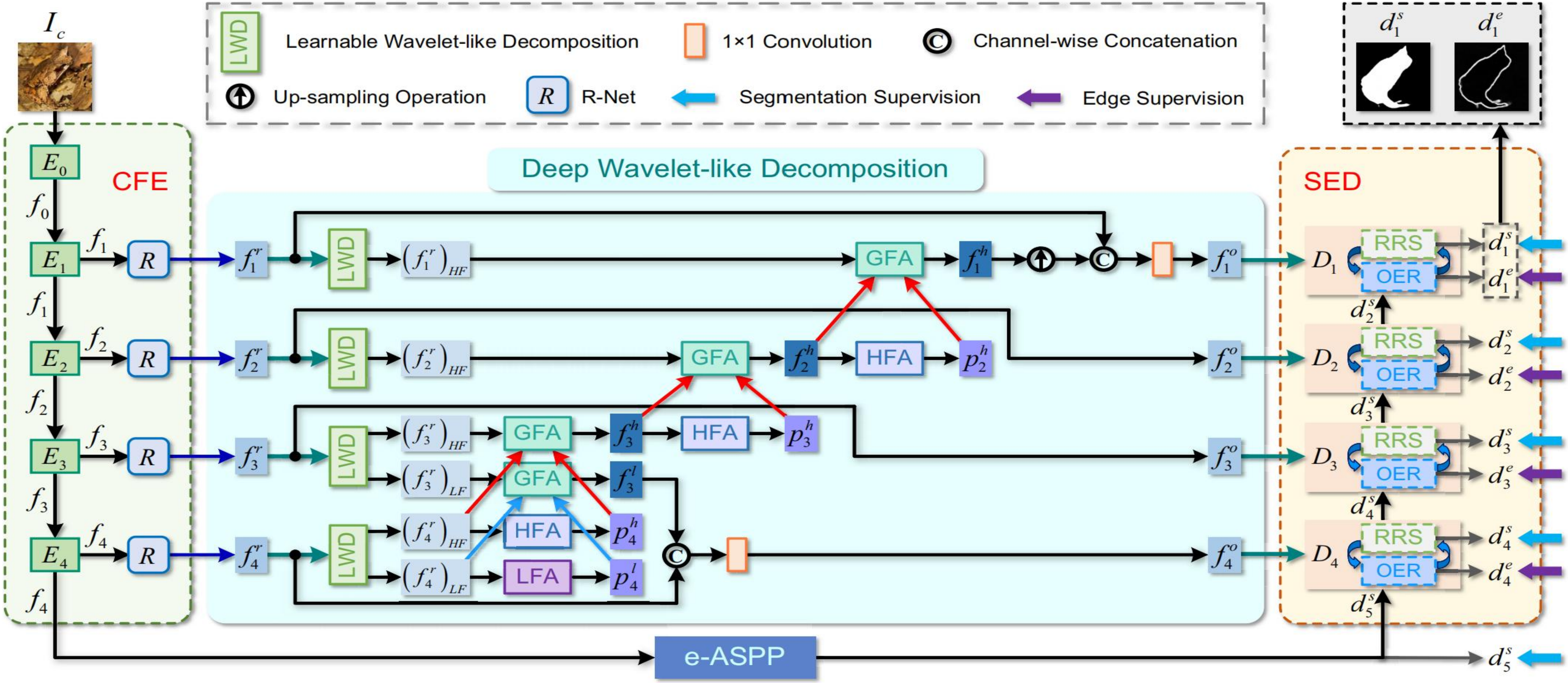
Tsinghua University

03

Methodology

Tsinghua University

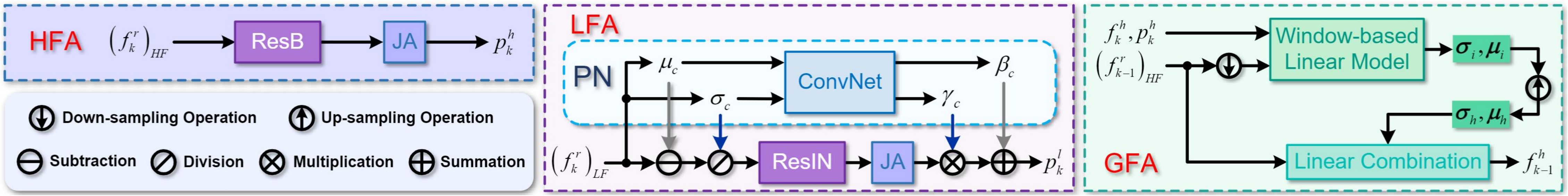
FEDER: Camouflaged Object Detection with Feature Decomposition and Edge Reconstruction



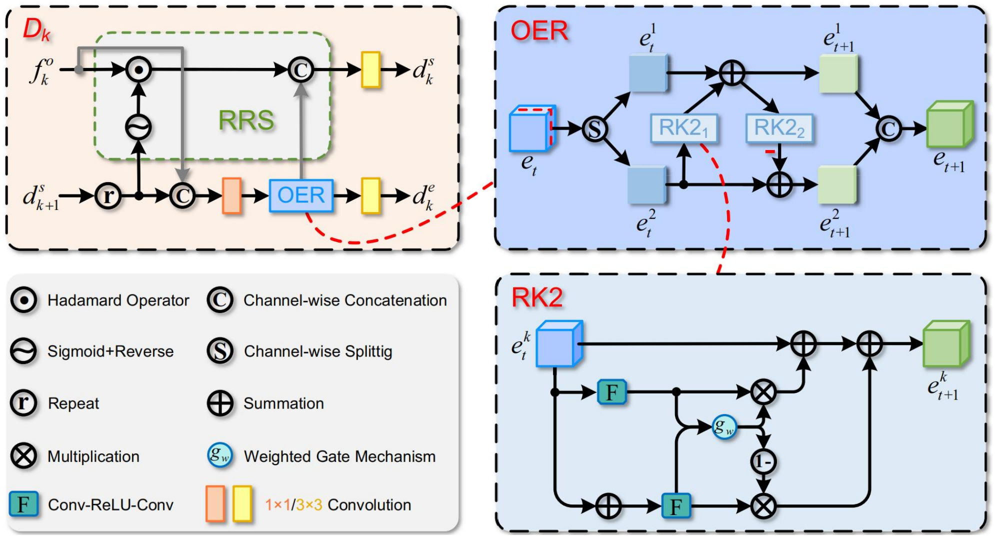
Tsinghua University

FEDER: Camouflaged Object Detection with Feature Decomposition and Edge Reconstruction

Details of HFA, LFA, and GFA



Details of RRS and OER



$$p_k^h = JA\left(ResB\left((f_k^r)_{HF}\right)\right), \quad (2)$$

$$p_k^l = JA\left(PN\left(ResIN\left((f_k^r)_{LF}\right)\right)\right), \quad (3)$$

$$\left(f_{k-1}^{dh}\right)_i = \sigma_w down\left(\left(f_{k-1}^r\right)_{HF}\right)_i + \mu_w, \forall i \in s_w, \quad (4)$$

$$\min_{\sigma_w,\mu_w} \sum_{i\in s_w} \left[\left(p_k^h\right)_i^2 \left(\left(f_{k-1}^{dh}\right)_i - \left((f_k^r)_{HF}\right)_i\right)^2 + \epsilon\sigma_w^2 \right], \quad (5)$$

$$f_{k-1}^{dh} = \boldsymbol{\sigma}_i \odot down((f_{k-1}^r)_{HF}) + \boldsymbol{\mu}_i, \quad (6)$$

$$\begin{aligned} f_{k-1}^h &= GFA\left((f_k^r)_{HF}, \left(f_{k-1}^r\right)_{HF}, p_k^h\right), \\ &= \boldsymbol{\sigma}_h \odot \left(f_{k-1}^r\right)_{HF} + \boldsymbol{\mu}_h. \end{aligned} \quad (7)$$

$$f_{k-1}^h = GFA\left(f_k^h, \left(f_{k-1}^r\right)_{HF}, p_k^h\right), \quad (8)$$

清華大學
Tsinghua University

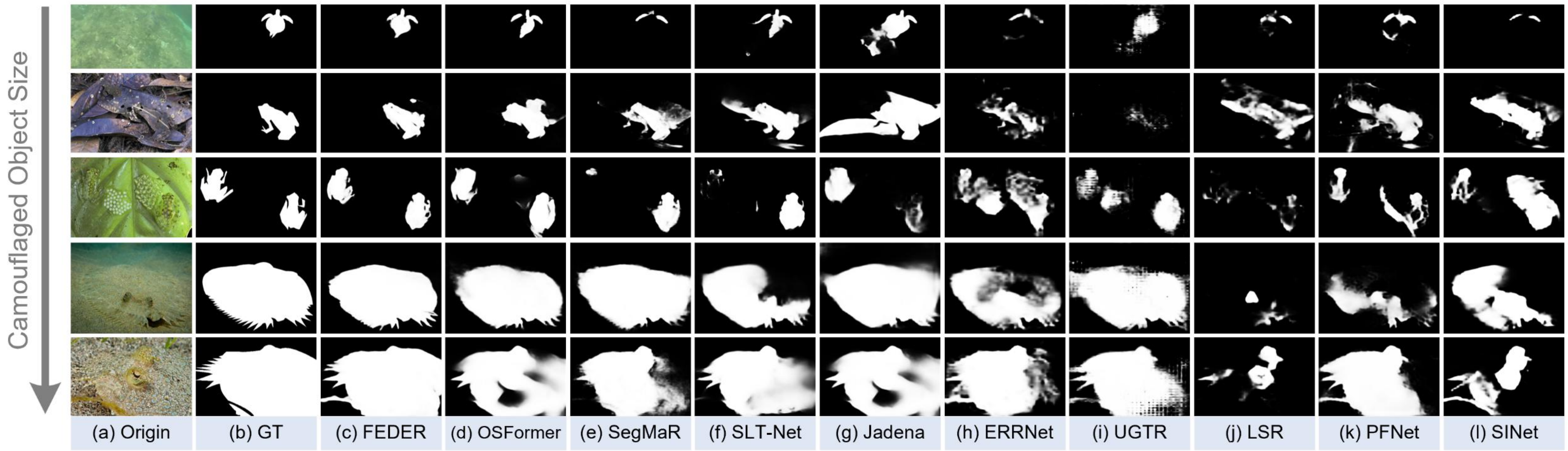
04

Experiments

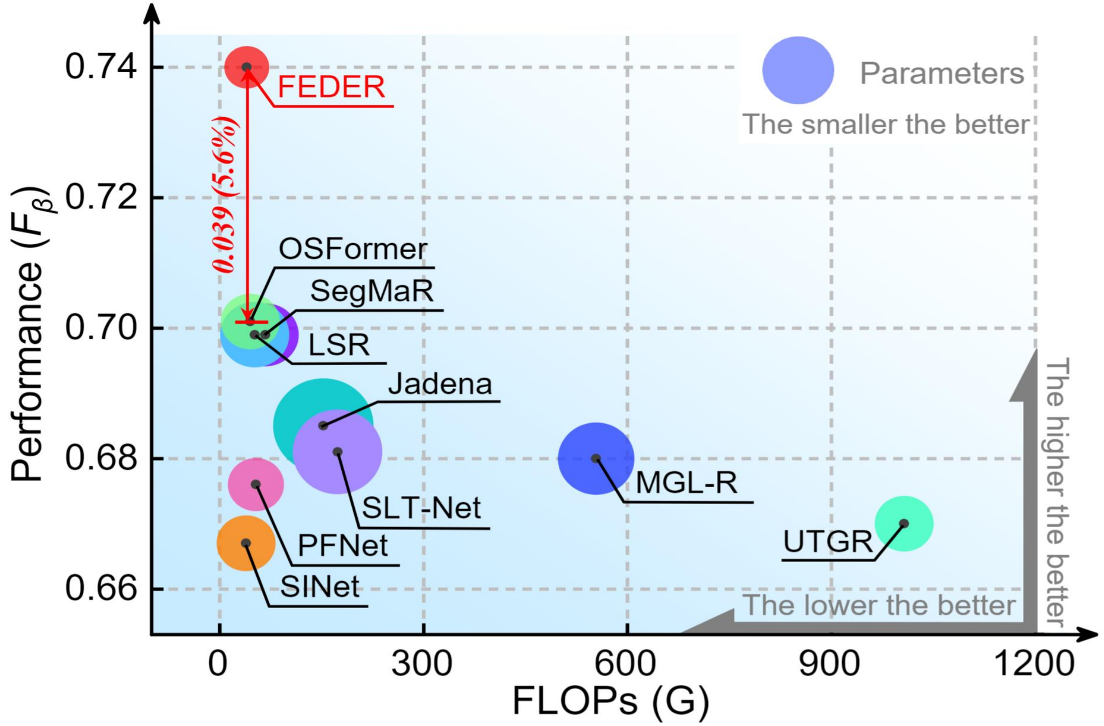
FEDER: Camouflaged Object Detection with Feature Decomposition and Edge Reconstruction

Methods	Publications	Backbones	*CHAMELEON* (76 images)				*CAMO* (250 images)				*COD10K* (2,026 images)				*NC4K* (4,121 images)			
			$M\downarrow$	$F_\beta\uparrow$	$E_\phi\uparrow$	$S_\alpha\uparrow$	$M\downarrow$	$F_\beta\uparrow$	$E_\phi\uparrow$	$S_\alpha\uparrow$	$M\downarrow$	$F_\beta\uparrow$	$E_\phi\uparrow$	$S_\alpha\uparrow$	$M\downarrow$	$F_\beta\uparrow$	$E_\phi\uparrow$	$S_\alpha\uparrow$
Common Setting: Single Input Scale and Single Stage																		
SINet [6]	CVPR20	ResNet50	0.034	0.823	0.936	0.872	0.092	0.712	0.804	0.745	0.043	0.667	0.864	0.776	0.058	0.768	0.871	0.808
LSR [25]	CVPR21	ResNet50	0.030	0.835	0.935	0.890	0.080	0.756	0.838	0.787	0.037	0.699	0.880	0.804	**0.048**	**0.802**	0.890	0.834
UGTR [48]	ICCV21	ResNet50	0.031	0.805	0.910	0.888	0.086	0.747	0.821	0.784	0.036	0.670	0.852	**0.817**	0.052	0.778	0.874	**0.839**
SLT-Net [2]	CVPR22	ResNet50	0.030	0.835	0.940	0.887	0.082	0.763	0.848	0.792	0.036	0.681	0.875	0.804	0.049	0.787	0.886	0.830
SegMaR-1 [14]	CVPR22	ResNet50	**0.028**	0.828	**0.944**	**0.892**	**0.072**	**0.772**	**0.861**	**0.805**	0.035	0.699	**0.890**	0.813	0.052	0.767	0.885	0.835
OSFormer [32]	ECCV22	ResNet50	**0.028**	**0.836**	0.939	0.891	0.073	0.767	0.858	0.799	**0.034**	**0.701**	0.881	0.811	0.049	0.790	**0.891**	0.832
FEDER-R50	—	ResNet50	**0.028**	**0.855**	**0.947**	**0.894**	**0.069**	**0.785**	**0.873**	**0.807**	**0.032**	**0.740**	**0.900**	**0.823**	**0.045**	**0.817**	**0.905**	**0.846**
SINet V2 [4]	TPAMI22	Res2Net50	0.030	0.816	0.942	0.888	0.070	0.779	0.882	0.822	0.037	0.682	0.887	0.815	0.048	0.792	0.903	0.847
BSA-Net [52]	AAAI22	Res2Net50	0.027	0.851	0.946	0.895	0.079	0.768	0.851	0.796	0.034	0.723	0.891	0.818	0.048	0.805	0.897	0.841
FEDER-R2N	—	Res2Net50	**0.026**	**0.856**	**0.947**	**0.903**	**0.066**	**0.807**	**0.897**	**0.836**	**0.029**	**0.748**	**0.911**	**0.844**	**0.042**	**0.824**	**0.913**	**0.862**
Other Setting: Multiple Input Scales (MIS)																		
ZoomNet [31]	CVPR22	ResNet50	0.024	0.858	0.943	0.902	0.066	0.792	0.877	0.820	0.029	0.740	0.888	**0.838**	0.043	0.814	0.896	0.853
FEDER-MIS	—	ResNet50	**0.023**	**0.869**	**0.959**	**0.906**	**0.064**	**0.801**	**0.893**	**0.827**	**0.028**	**0.756**	**0.913**	0.837	**0.041**	**0.832**	**0.915**	**0.859**
Other Setting: Multiple Stages (MS)																		
SegMaR-4 [14]	CVPR22	ResNet50	**0.025**	0.855	0.955	0.906	0.071	0.779	0.865	0.815	0.033	0.737	0.896	0.833	0.047	0.793	0.892	0.845
FEDER-MS-4	—	ResNet50	**0.025**	**0.874**	**0.964**	**0.907**	**0.067**	**0.809**	**0.886**	**0.822**	**0.028**	**0.752**	**0.917**	**0.851**	**0.042**	**0.827**	**0.917**	**0.863**

FEDER: Camouflaged Object Detection with Feature Decomposition and Edge Reconstruction



Computational efficiency



Edge reconstruction results

清華大學
Tsinghua University

Thanks for listening.

Chunming He