Structure-measure: A New Way to Evaluate Foreground Maps

Deng-Ping Fan[1] Ming-Ming Cheng[1] Yun Liu[1]

Tao Li[1] Ali Borji[2]

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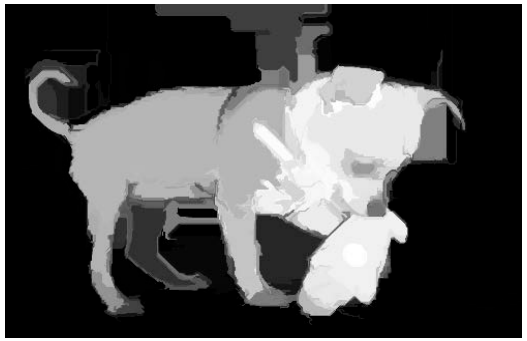
1 NANKAI UNIVERSITY TIANJIN

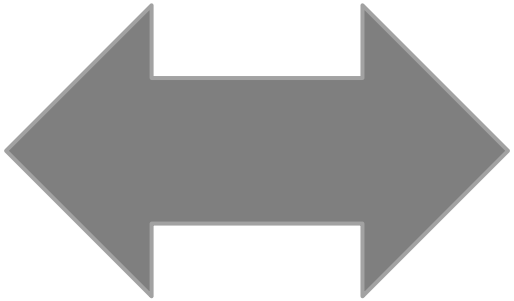
2 UCF

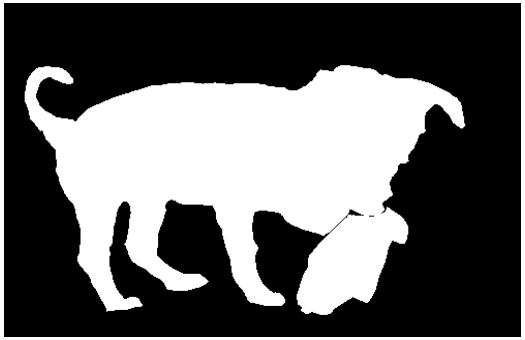
Goal



Foreground map (FM)

Similarity?

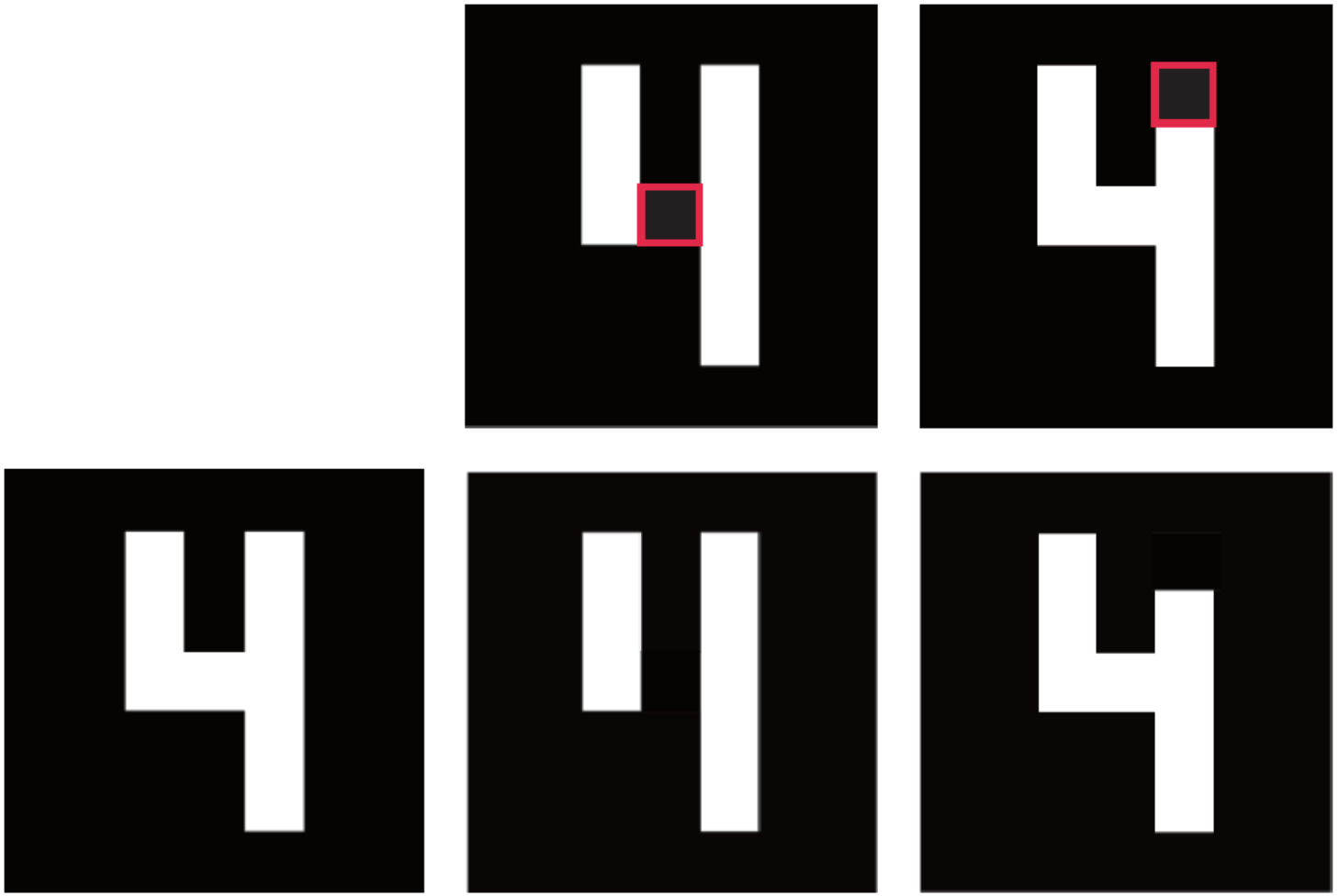




Ground Truth (GT)

S-measure

Pixel-wise based measures (AP, AUC)



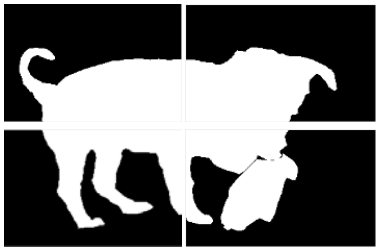
(a) GT (b) FM1 (c) FM2

S-measure

Motivation

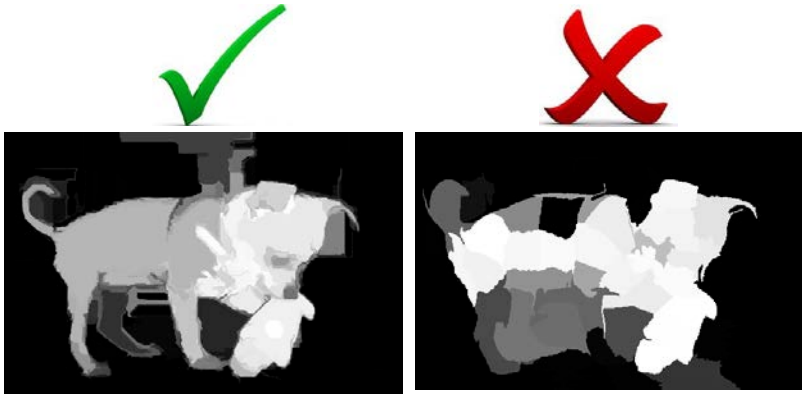
- **Region**

structure consistency of **object-parts;**



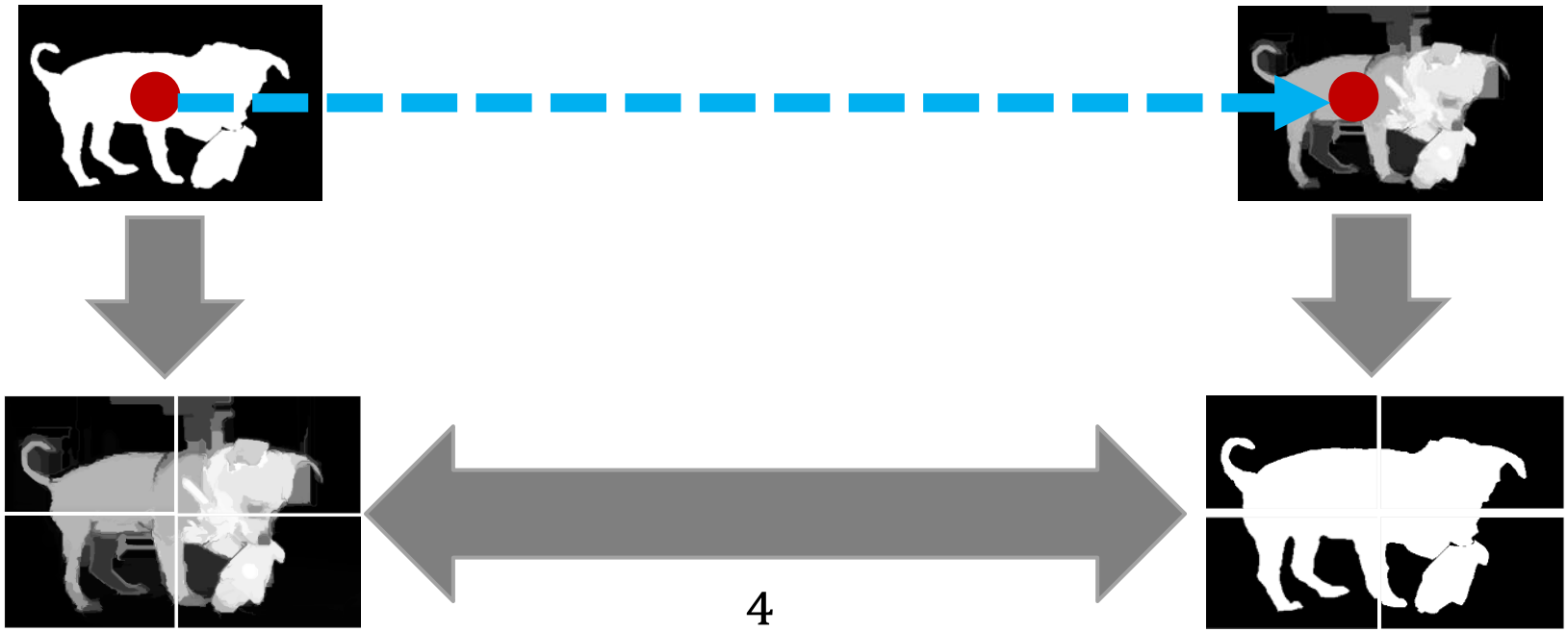
- **Object**

uniformly distributed;
contrast sharply;



S-measure

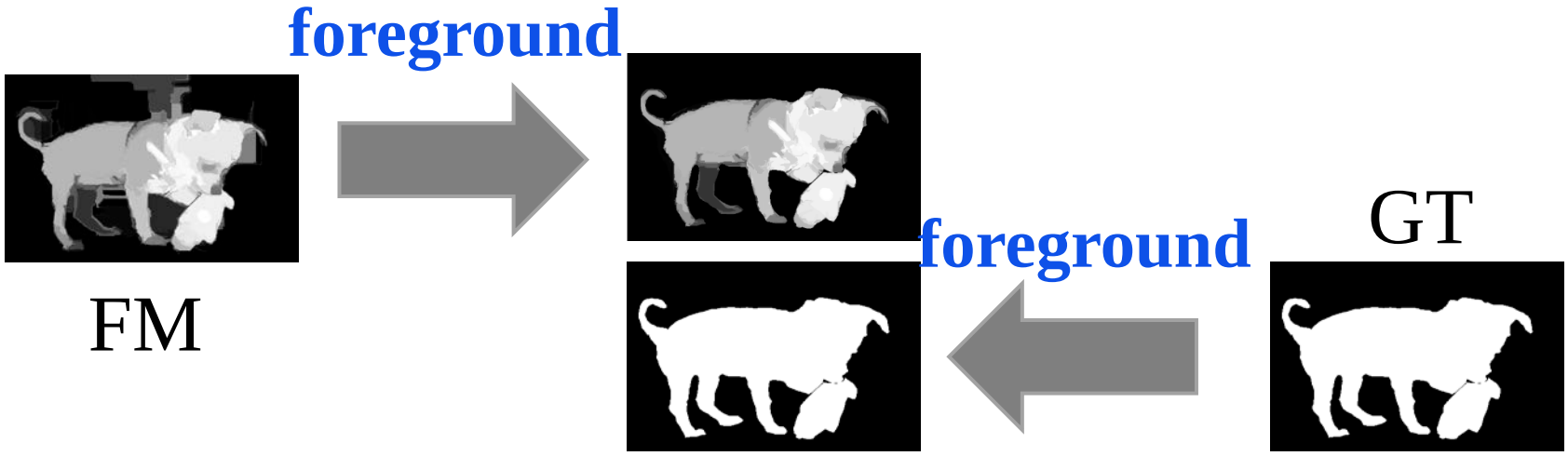
Region-Level



$$S_{region} = \sum_{j=1}^{4} w_j * ssim_j$$

Image quality assessment: from error visibility to structural similarity , IEEE TIP 2004, Z Wang, AC Bovik et. al.

Object-Level: foreground



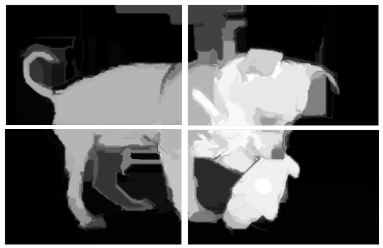
$$D_{FG} = \frac{(\bar{x}_{FG})^2 + (\bar{y}_{FG})^2}{2\bar{x}_{FG}\bar{y}_{FG}} + \boldsymbol{\lambda} * \frac{\boldsymbol{\sigma}_{x_{FG}}}{\bar{x}_{FG}}$$

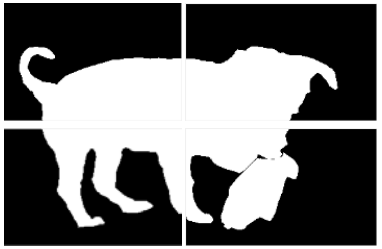
contrast **uniform**

$$O_{FG} = \frac{1}{D_{FG}}$$

S-measure

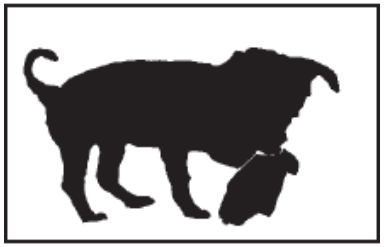
Framework

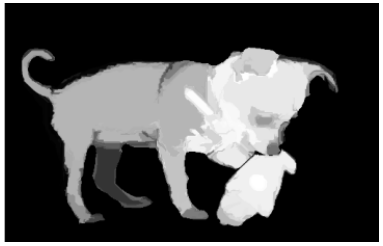


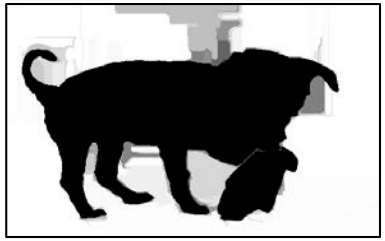


S_{region}

+





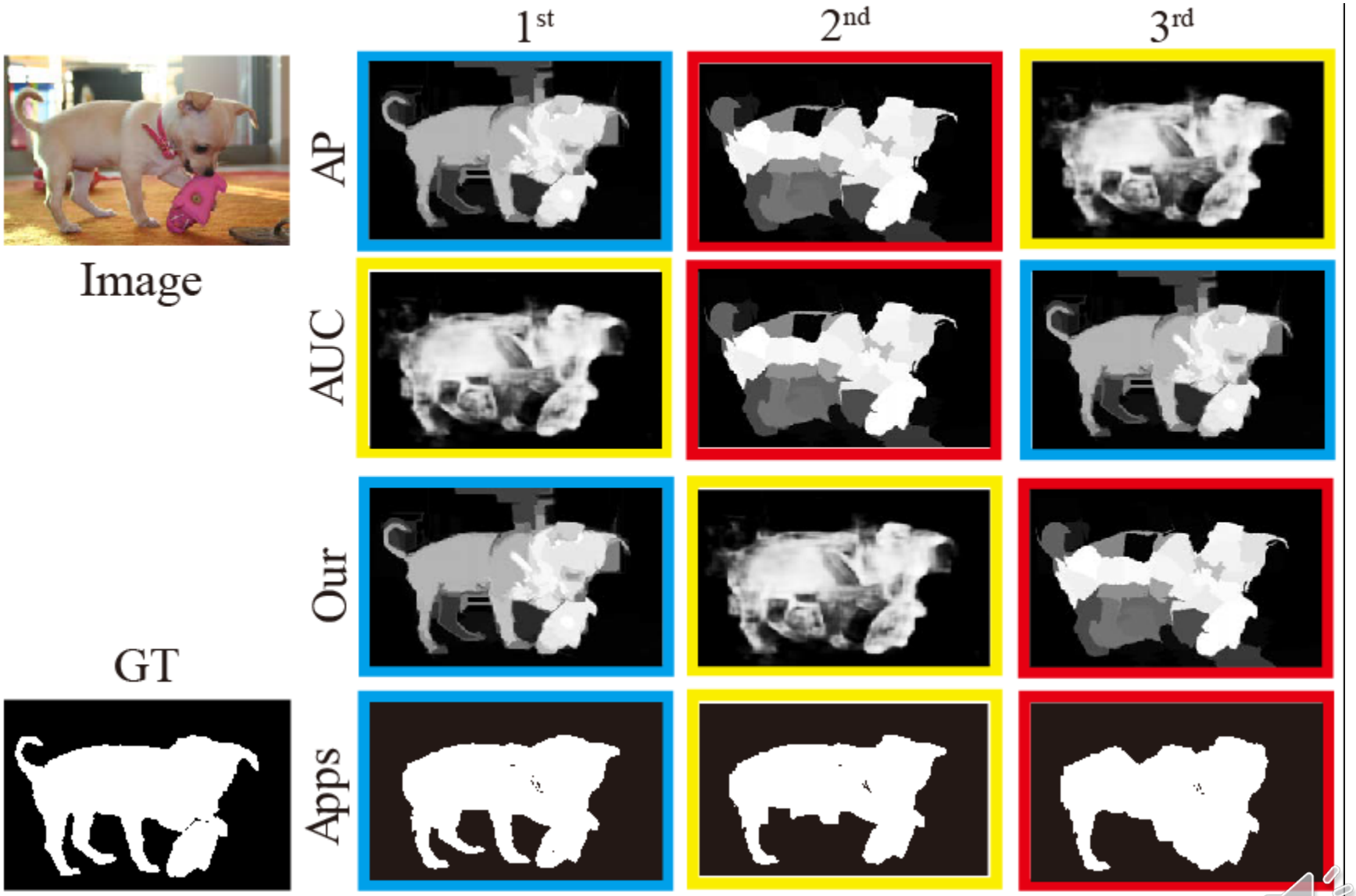


$S_{object} = u * O_{FG} + v * O_{BG}$

=

$S = \boldsymbol{\alpha} * S_{region} + (1 - \boldsymbol{\alpha}) * S_{object}$

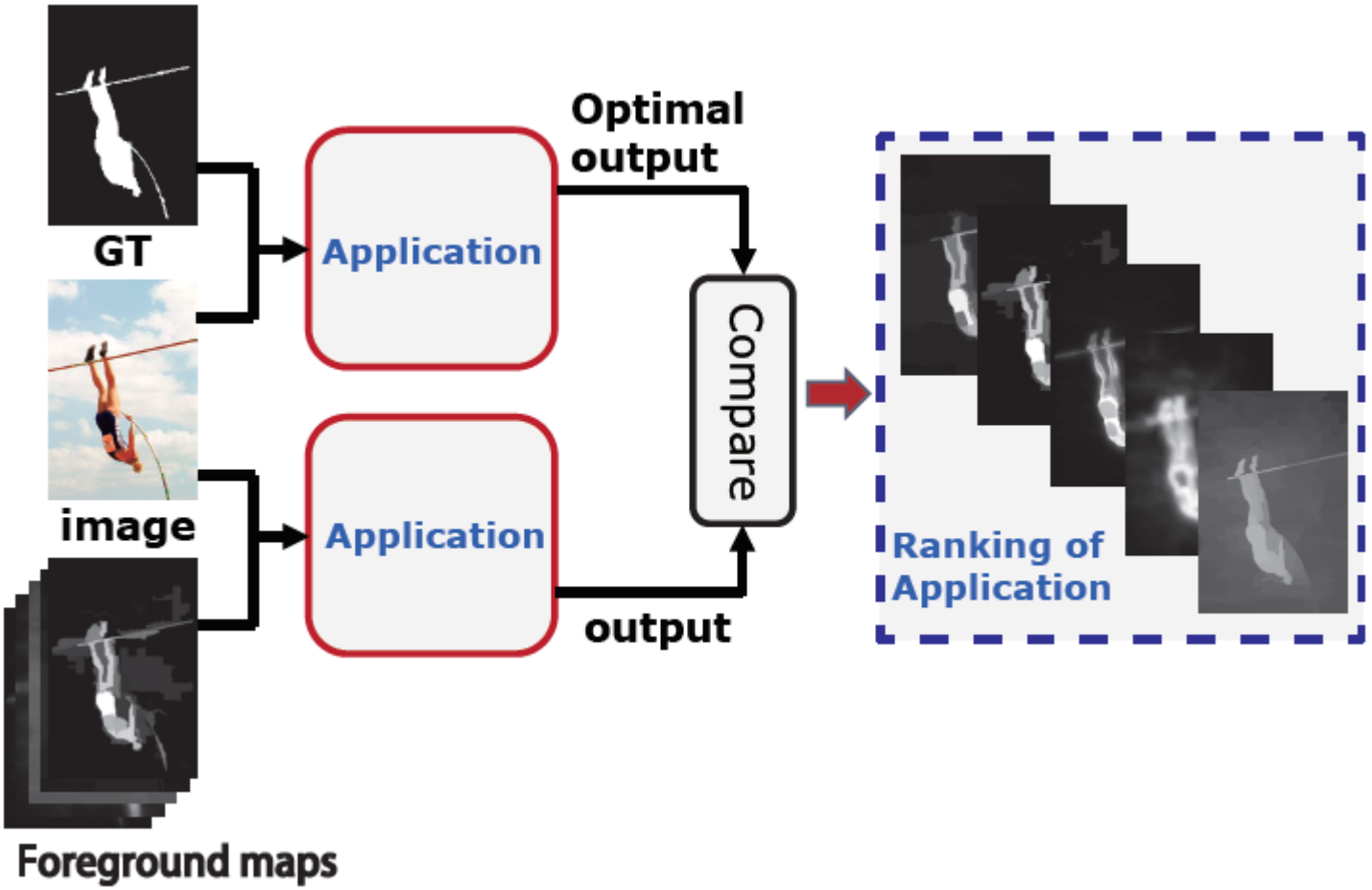
Ranking example



S-measure

Meta-Measure1

- Agree with the **application**: Saliency Cut



S-measure

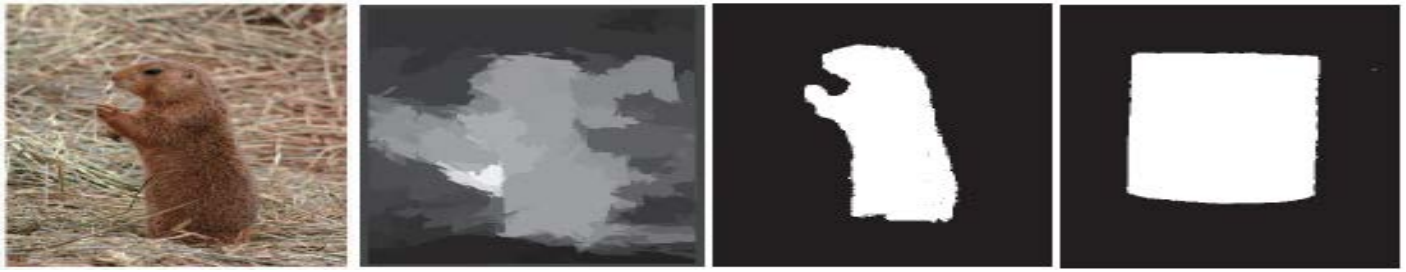
Meta-Measure-2

- Prefer a good result over an **Generic** result

(a)Image (b)GT (c)FM1 (d)Generic

Meta-Measure-3

- **WRONG** ground-truth decrease score

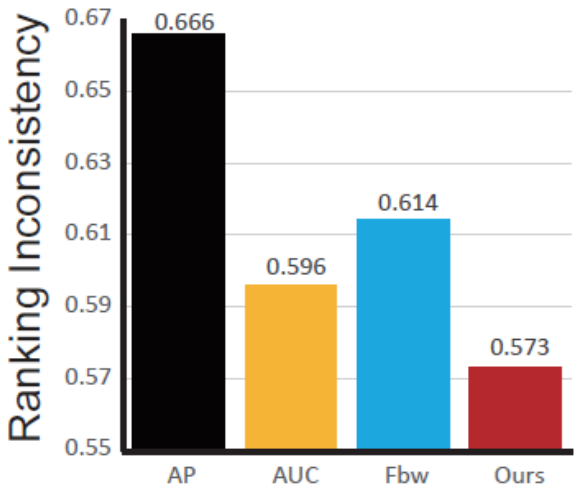


(a)Image (b)FM (c)GT (d)WRONG GT

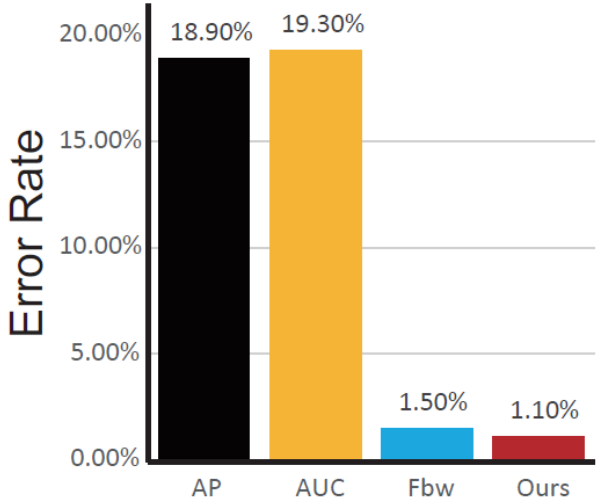
S-measure

Results

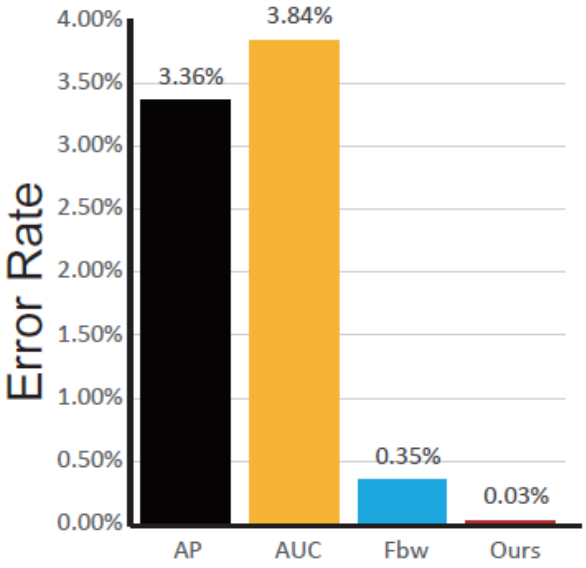
- Results in ASD dataset.



(a)Meta-measure1



(b)Meta-measure2



(c)Meta-measure3

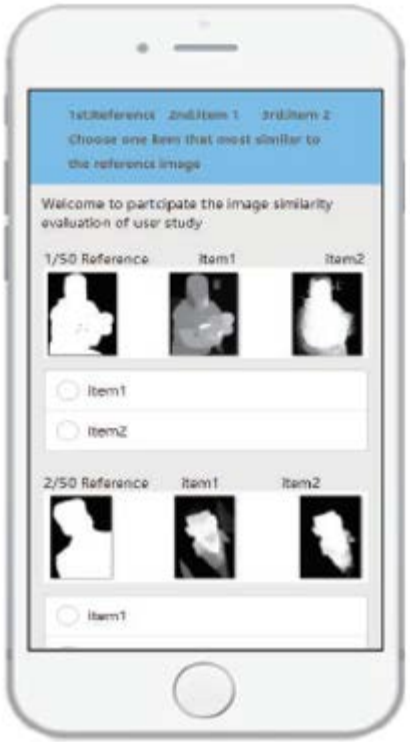
- Results in other popular datasets.

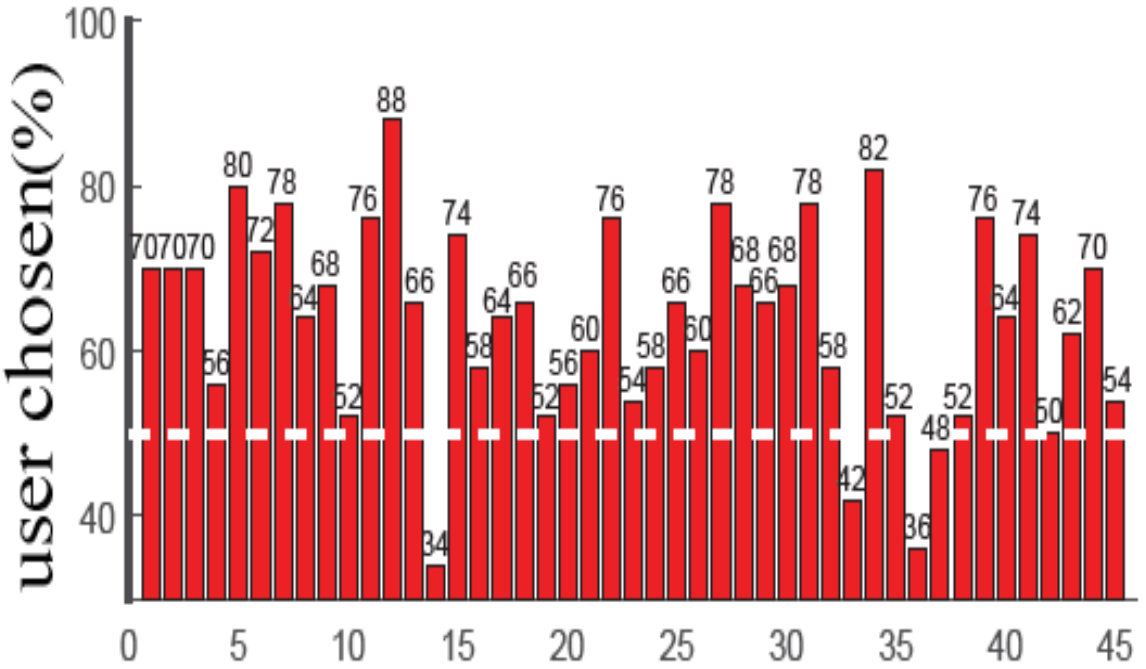
	PASCAL-S [31]			ECSSD [47]			SOD [37]			HKU-IS [27]		
	MM1	MM2(%)	MM3(%)	MM1	MM2(%)	MM3(%)	MM1	MM2(%)	MM3(%)	MM1	MM2(%)	MM3(%)
AP	0.452	12.1	5.50	0.449	9.70	3.32	0.504	9.67	7.69	0.518	3.76	1.25
AUC	0.449	15.8	8.21	0.436	12.1	4.18	0.547	14.0	8.27	0.519	7.02	2.12
Fbw	0.365	7.06	1.05	0.401	**3.00**	0.84	0.384	16.3	0.73	0.498	0.36	0.26
Ours	**0.320**	**4.59**	**0.34**	**0.312**	3.30	**0.47**	**0.349**	**9.67**	**0.60**	**0.424**	**0.34**	**0.08**

S-measure

Meta-Measure 4

- Agree with the **human ranking**.





~62% viewer preferred the map chosen by our measure.

Thanks!

http://dpfan.net/smeasure/

S-measure