Structure-measure: A New Way to Evaluate Foreground Maps

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ICCV 2017 (Spotlight)

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Goal
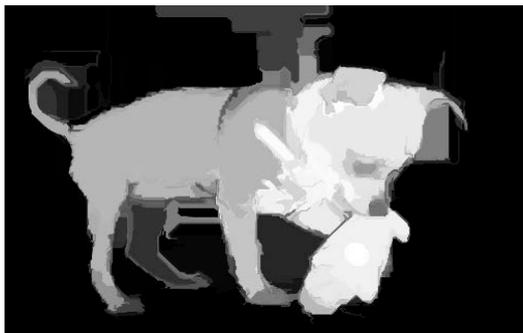
Similarity?
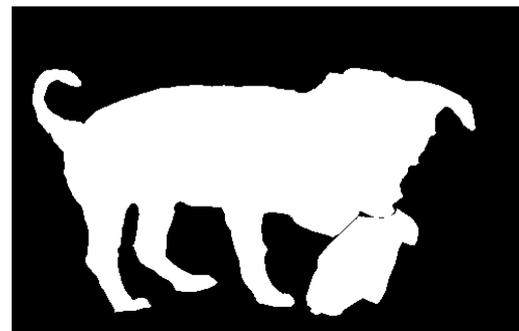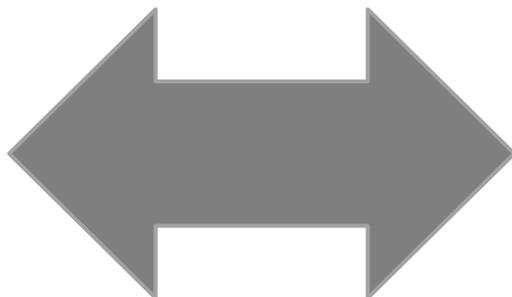
Foreground map (FM)

Ground Truth (GT)

S-measure

Pixel-wise based measures (AP, AUC)

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

S-measure
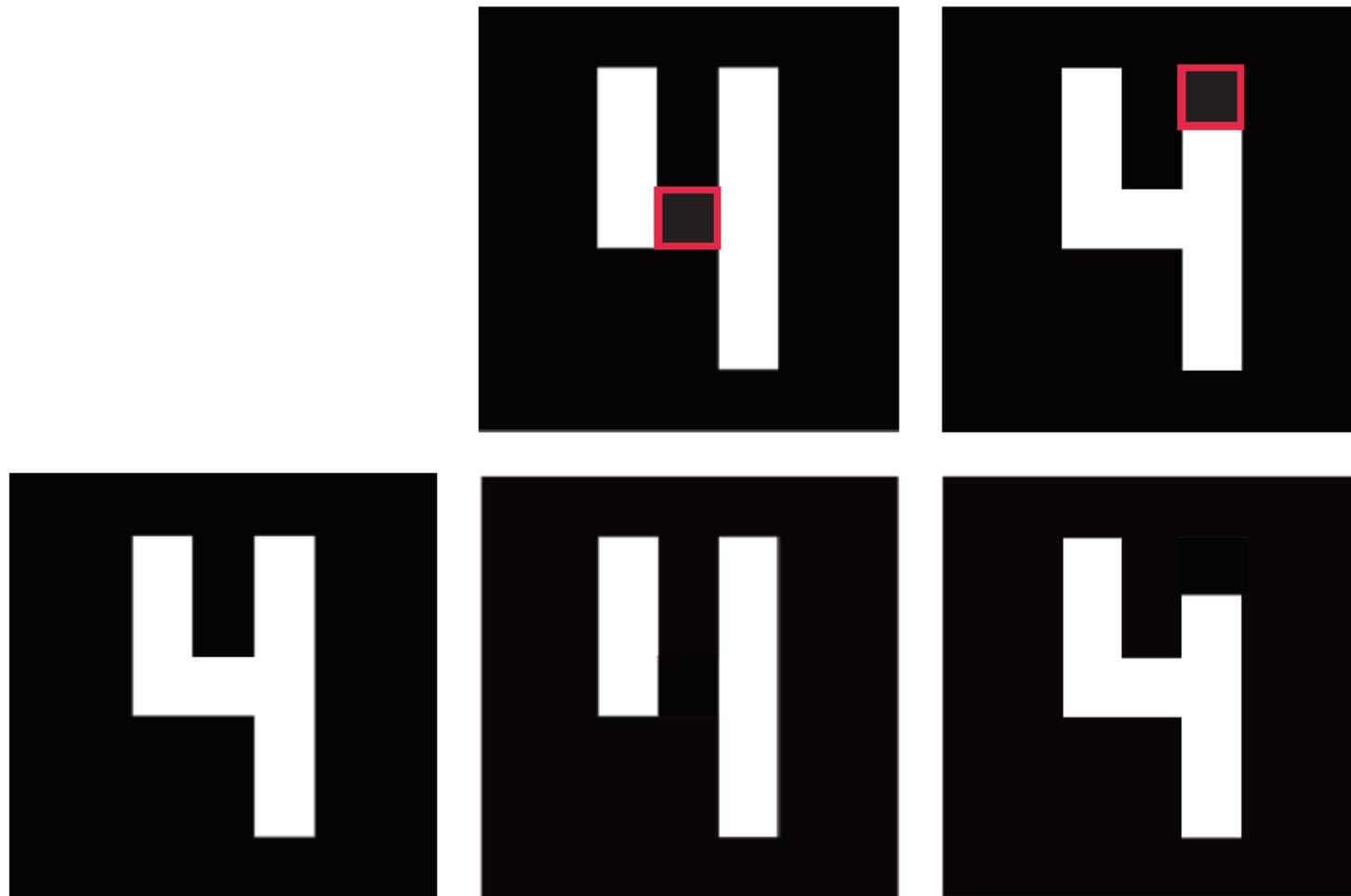
Motivation

- **Region**
structure consistency
of **object-parts;**
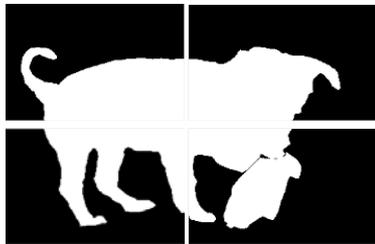
- **Object**
**uniformly** distributed;
contrast sharply;
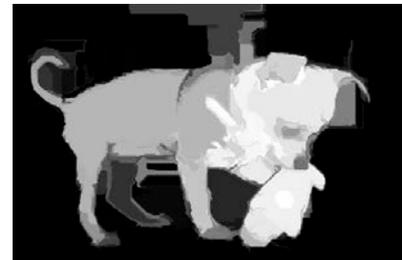
Region-Level
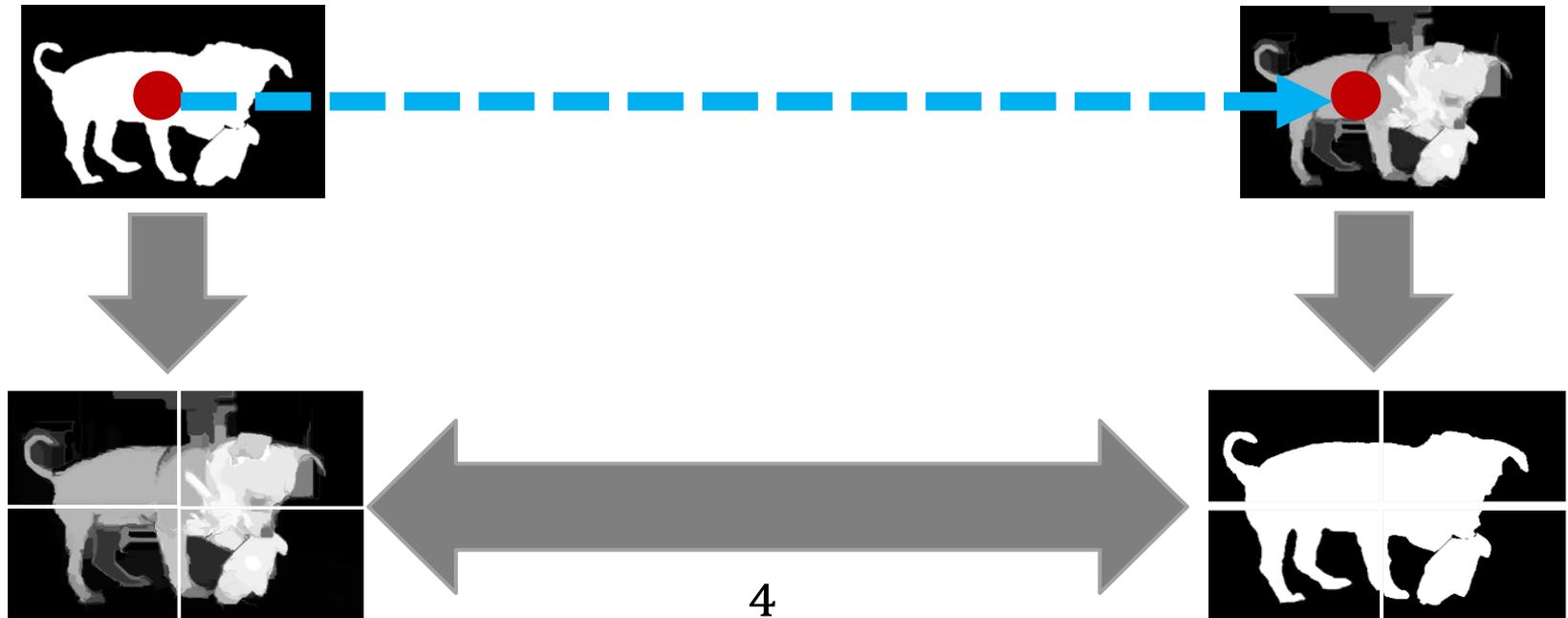
$$S_{region} = \sum_{j=1}^{4} w_j * ssim_j$$

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

Object-Level: foreground

foreground

FM

GT

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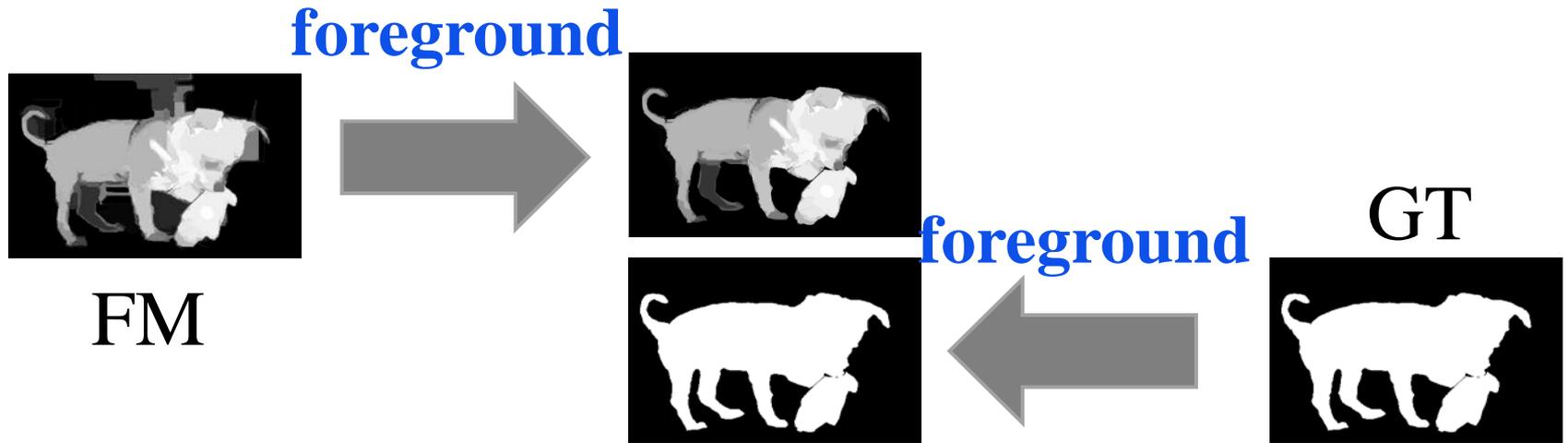
$$D_{FG} = \boxed{\frac{(\bar{x}_{FG})^2 + (\bar{y}_{FG})^2}{2\bar{x}_{FG}\bar{y}_{FG}}} + \boldsymbol{\lambda} * \boxed{\frac{\boldsymbol{\sigma}_{x_{FG}}}{\bar{x}_{FG}}}$$

contrast

uniform

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

S-measure

Framework

$$S_{region}$$

$$+$$

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

$$||$$

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

Ranking example

Image

GT

1st 2nd 3rd

AP AUC Our Apps
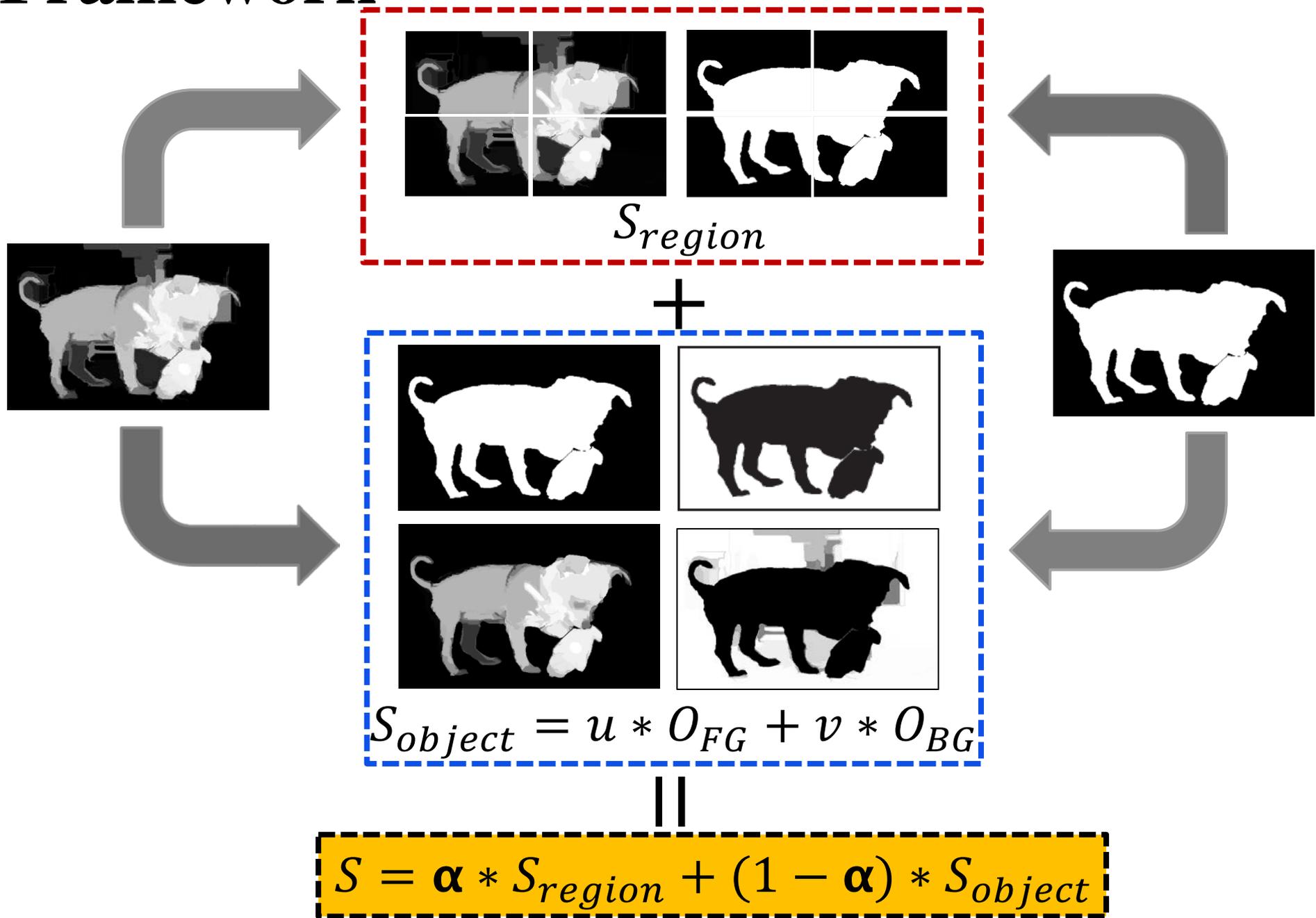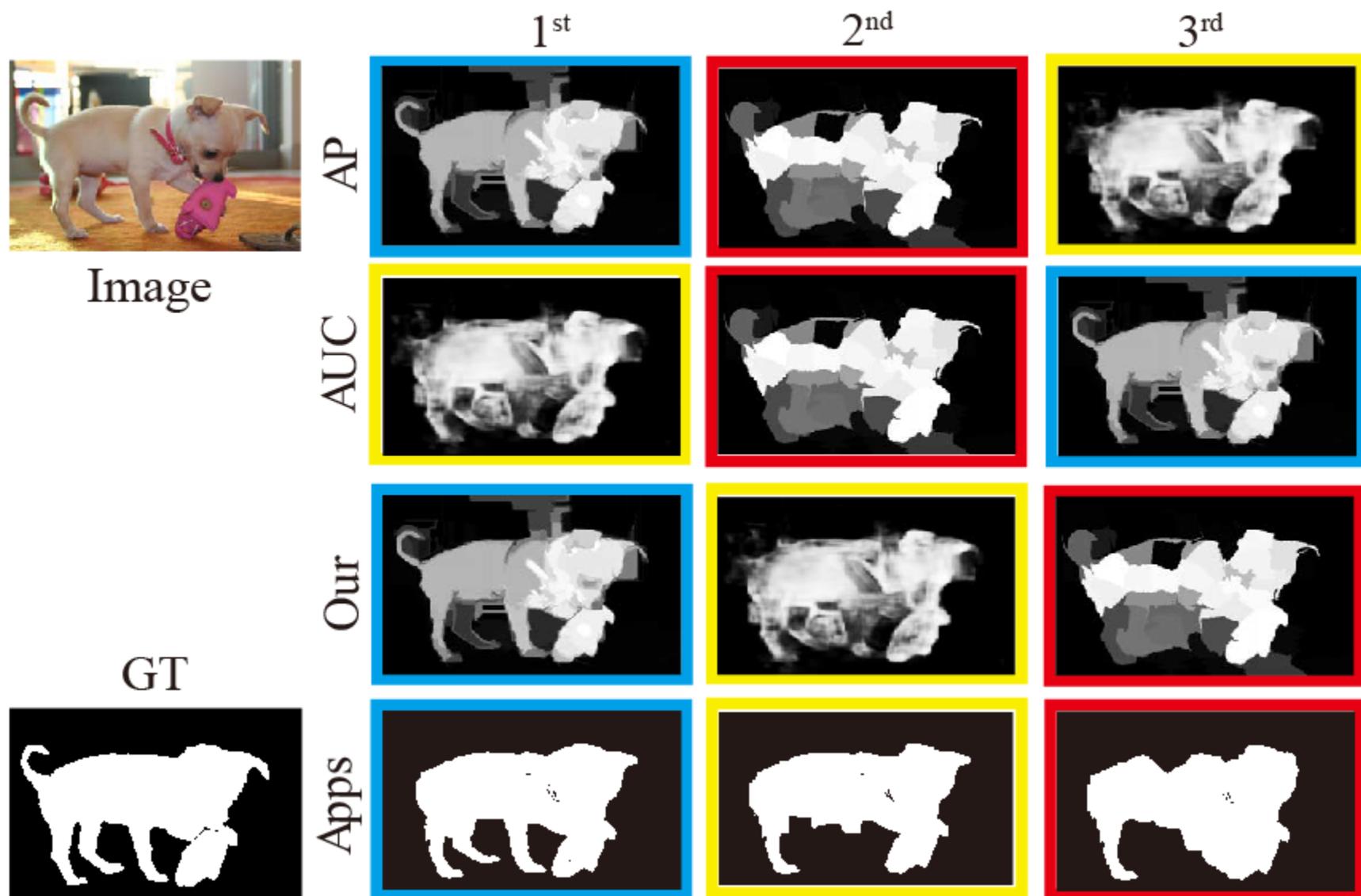
S-measure

Meta-Measure1

▸ Agree with the **application**: Saliency Cut
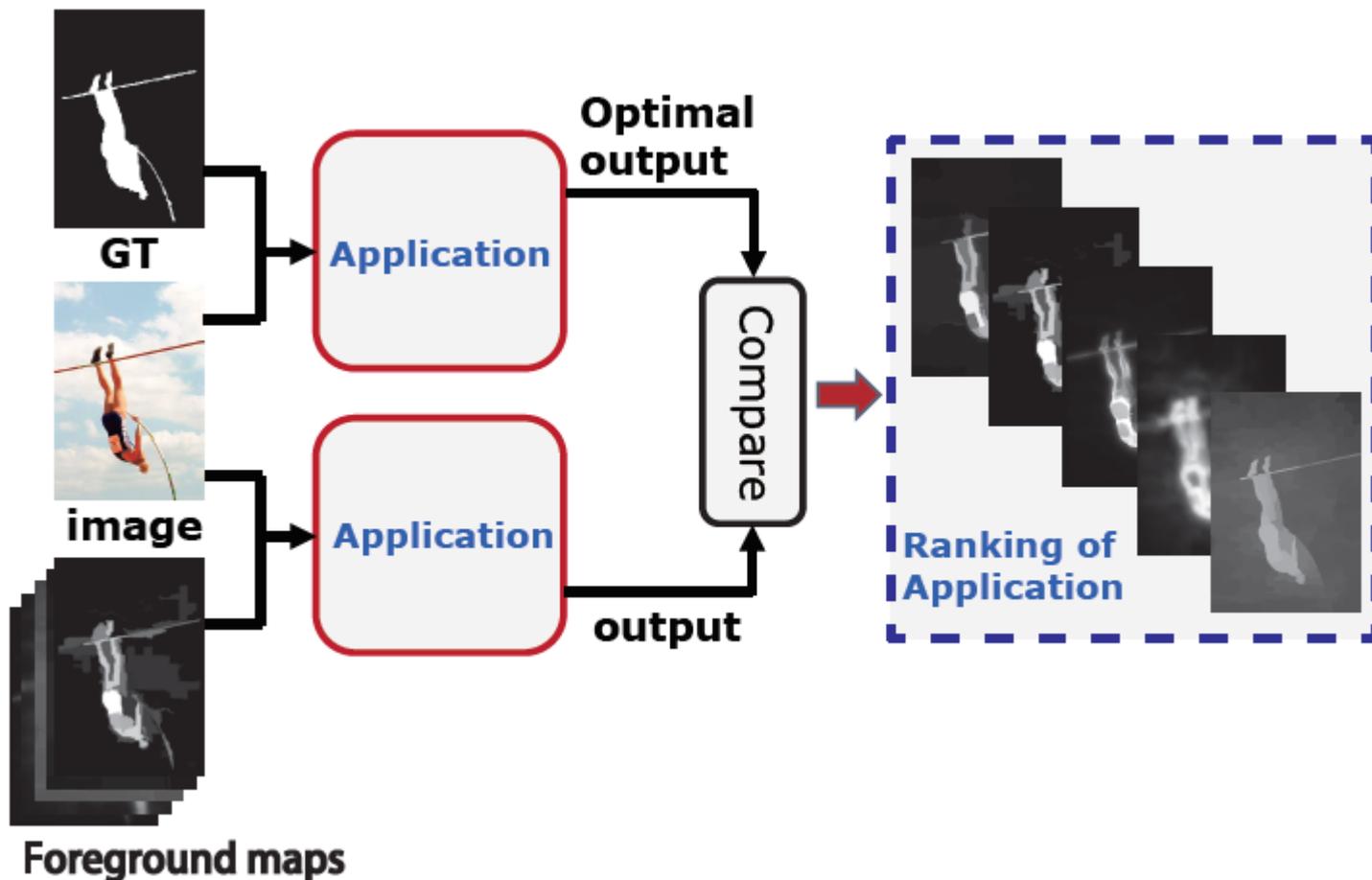
# Meta-Measure-2

▸ Prefer a good result over an **Generic** result
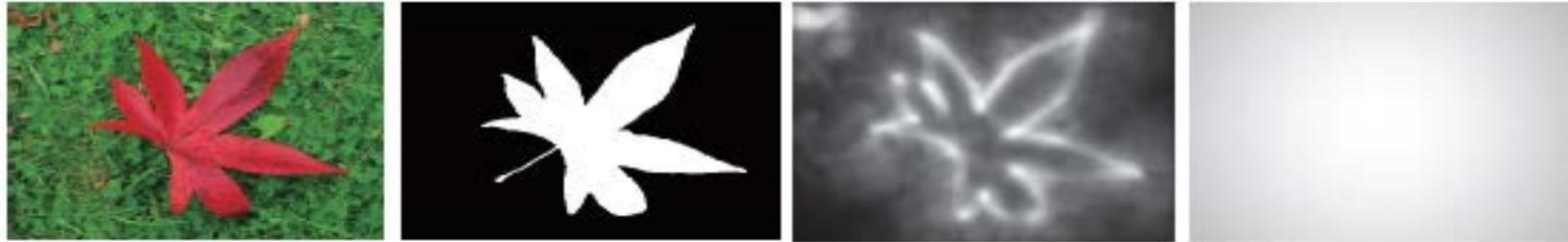
(a)Image　　(b)GT　　(c)FM1　(d)Generic

Meta-Measure-3

▸ **WRONG** ground-truth decrease score
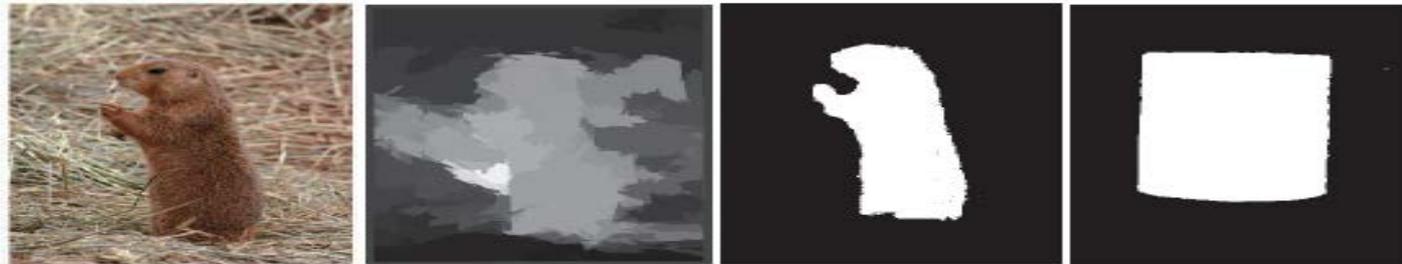
(a)Image　　(b)FM　　(c)GT　(d)WRONG GT

**S-measure**

Results

▸ Results in ASD dataset.

(a)Meta-measure1   (b)Meta-measure2   (c)Meta-measure3
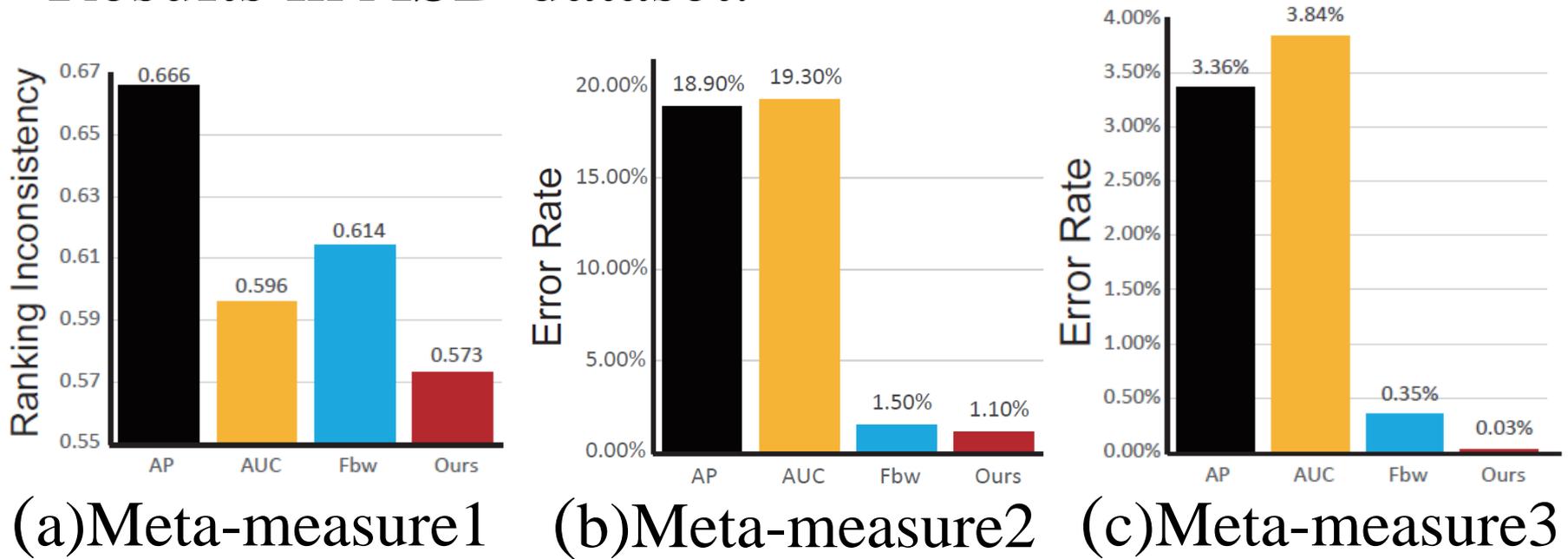
▸ Results in other popular datasets.

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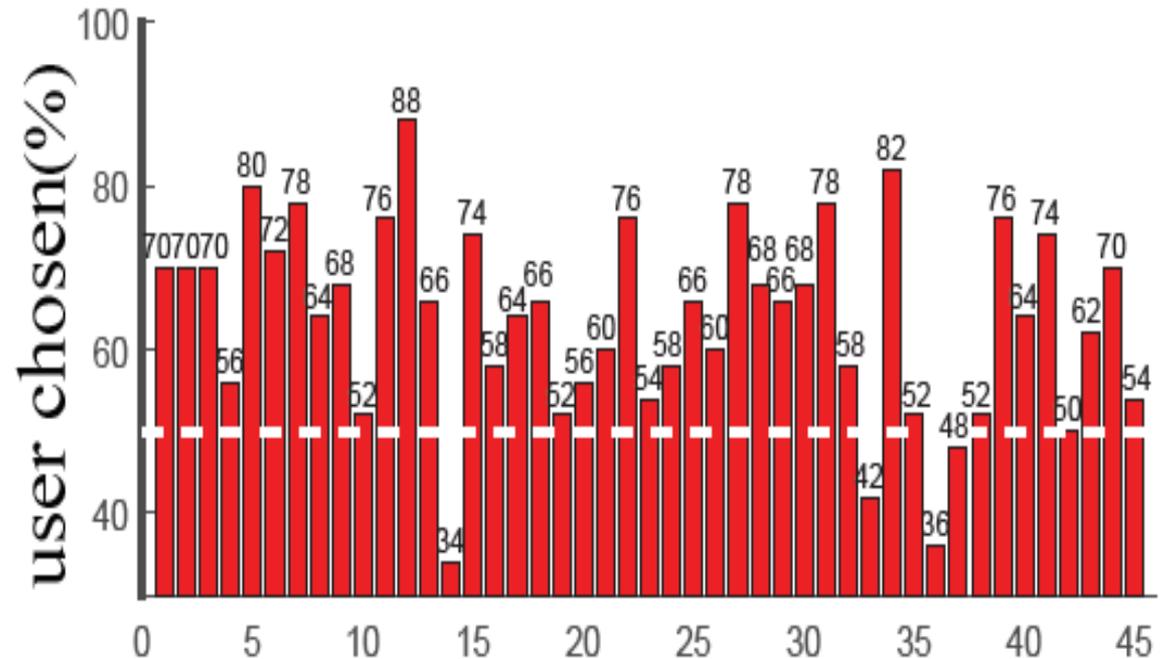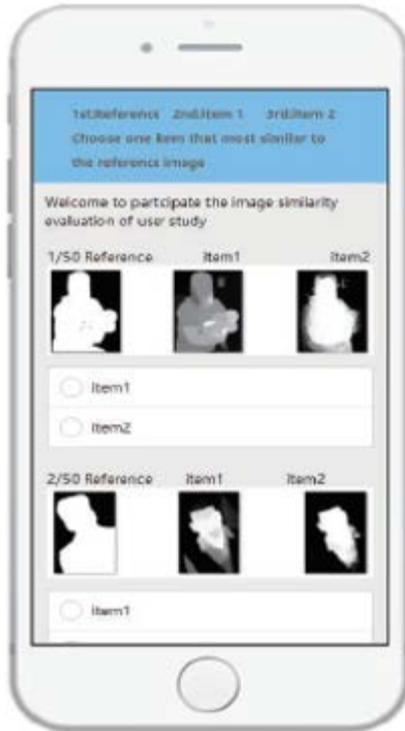
~62% viewer preferred the map chosen by our measure.

Thanks!

http://dpfan.net/smeasure/

S-measure