Size and Location Matter: a New Baseline for Salient Object Detection

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Overview

We propose a new baseline method for saliency detection. It simply considers a large region close to the image center as salient, and defines the saliency of a region i as the product of its size A(i) and centerness C(i): $S = C(i) \times \sqrt{A(i)}$. As accurate image segmentation problem is difficult, a novel geodesic filtering framework is presented to estimate these attributes in a soft manner, without hard image segmentation.

- **Advantages**
  1) Concepts are simple and intuitive
  2) A strong baseline method achieves very competitive results
  3) Highly complementary with the state-of-the-art
  4) Fast, easy to implement

Geodesic Connectivity and Filtering

- **Geodesic Connectivity**
  1) Construct a superpixel [1] graph
  2) Compute the pair-wise shortest paths *dist*
  3) Geodesic connectivity between i, j:

$$con(i,j) = \exp\left(\frac{-dist(i,j)^2}{2\sigma^2}\right) \in [0,1]$$

Geodesic connectivity is a continuous measure of how well any two superpixels are spatially connected. A superpixel only has large connectivity values (near 1) for ones in the same homogeneous region, and has near 0 values for the others.

- **Geodesic Filtering**

A smoothing process using geodesic connectivity, which is useful to compute region properties in a soft manner:

$$\widetilde{GF} = \sum_{j=1}^{N} con(i,j) \times M(j)$$

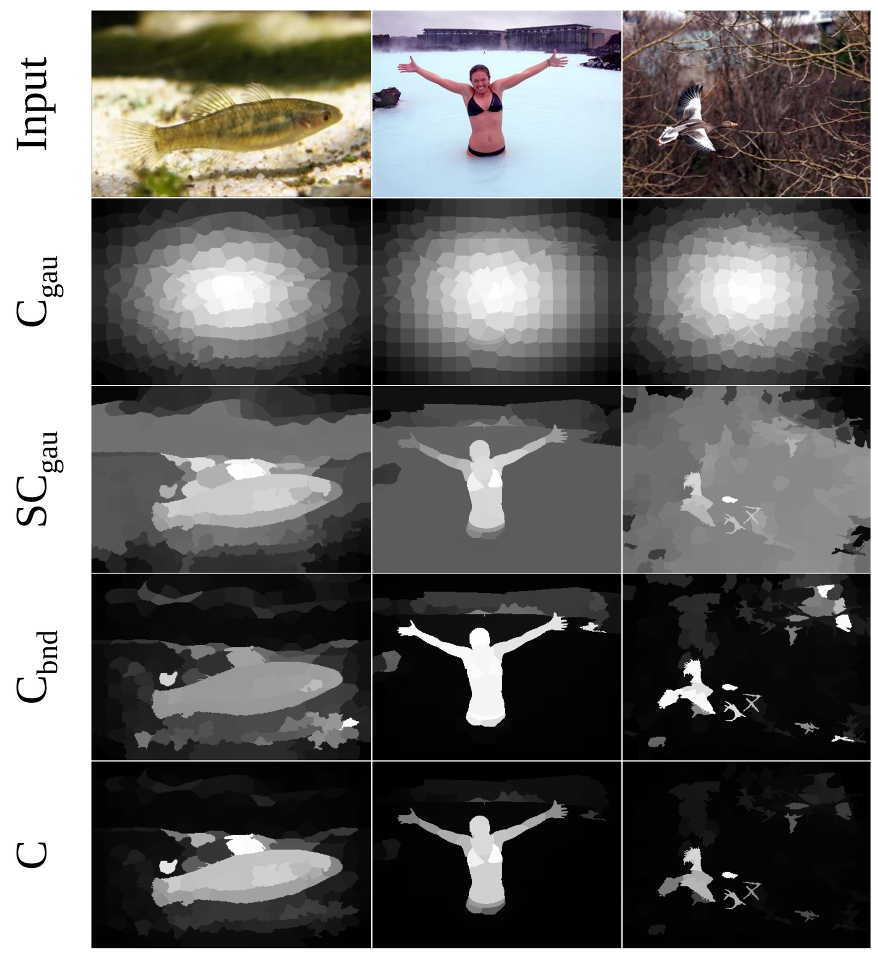
$$GF(M,i) = \frac{\widetilde{GF}}{\sum_{j=1}^{N} con(i,j)}$$

where N is the number of superpixels, and $M(i)$ is the region property value of superpixel i

- **Advantages**
  1) Without hard image segmentation
  2) Produce stable results with easy-to-set parameters

Computation of Region Centerness and Size

- **Adaptive Computation of Region Centerness**



In order to make centerness map to be highly adaptive to the image content, and suitable for both off-center and multiple objects, our final centerness map is defined as: $C = SC_{gau} \times C_{bnd}$

1) Use GF to "smooth" naive Gaussian fall-off map C_{gau}:

$$SC_{gau} = GF(C_{gau})$$

2) Compute C_{bnd} to suppress large background regions, which always touch different sides of the image boundary:

$$C_{bnd}(i) = \sqrt[4]{L(i) \times T(i) \times R(i) \times B(i)}$$

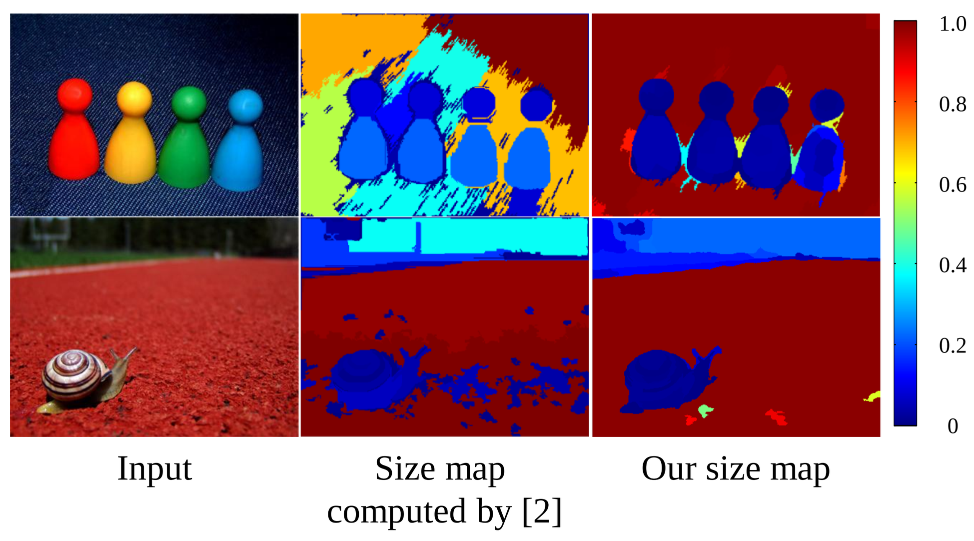
where L(i), T(i), R(i), B(i) are the geodesic distances of superpixel i to the left, top, right, and bottom boundaries of the image

- **Approximate Computation of Region Size**

We count the number of superpixels (of similar sizes and shapes) in a homogeneous region to approximate size of the region. $\widetilde{GF}$ can be used to "sum" all superpixels in the same homogeneous region softly, producing more stable results than hard segmentation methods (such as [2]):

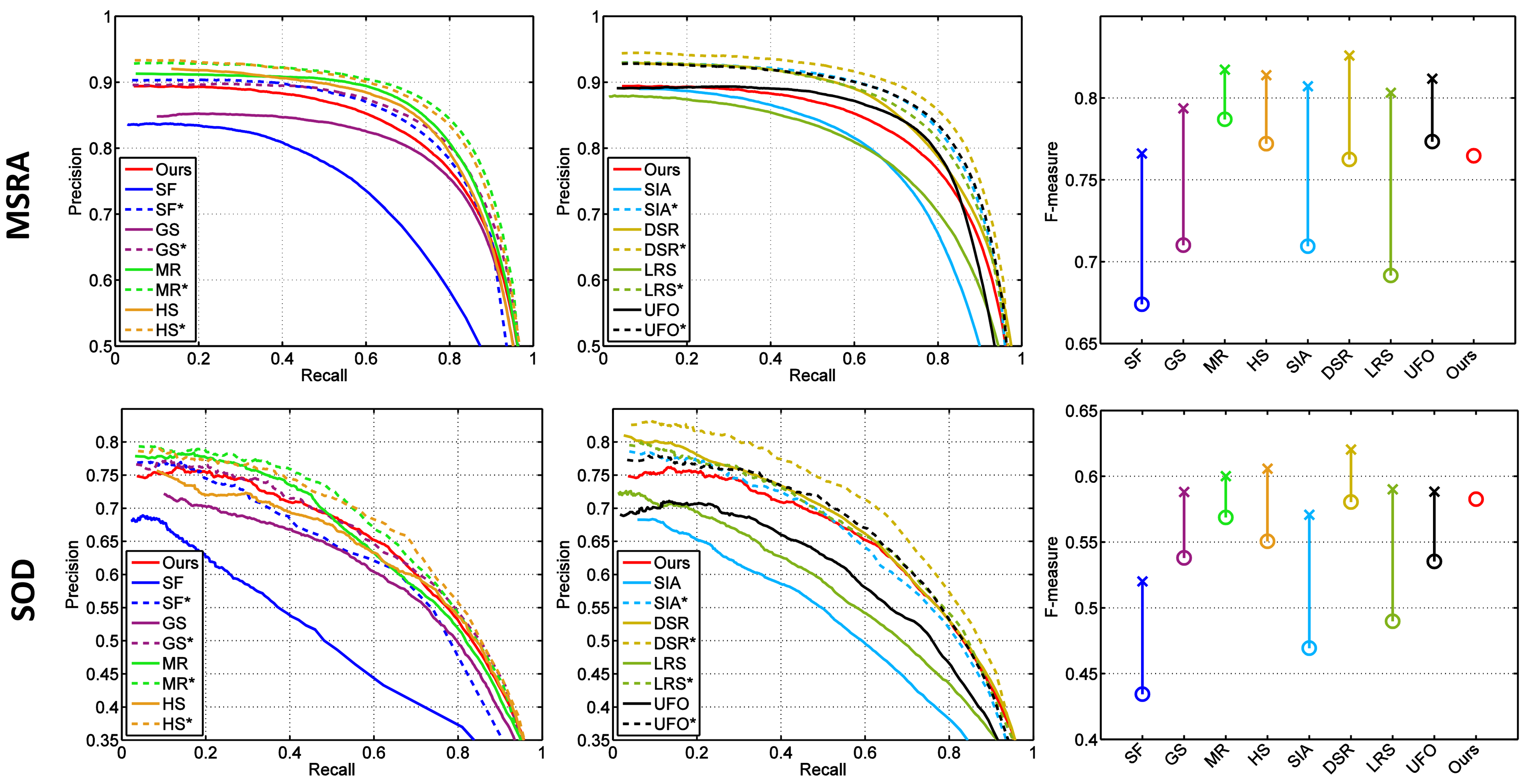
$$A = \widetilde{GF}(U)$$

where U is a uniform map that has the same normalized area for all the superpixels



Experiments

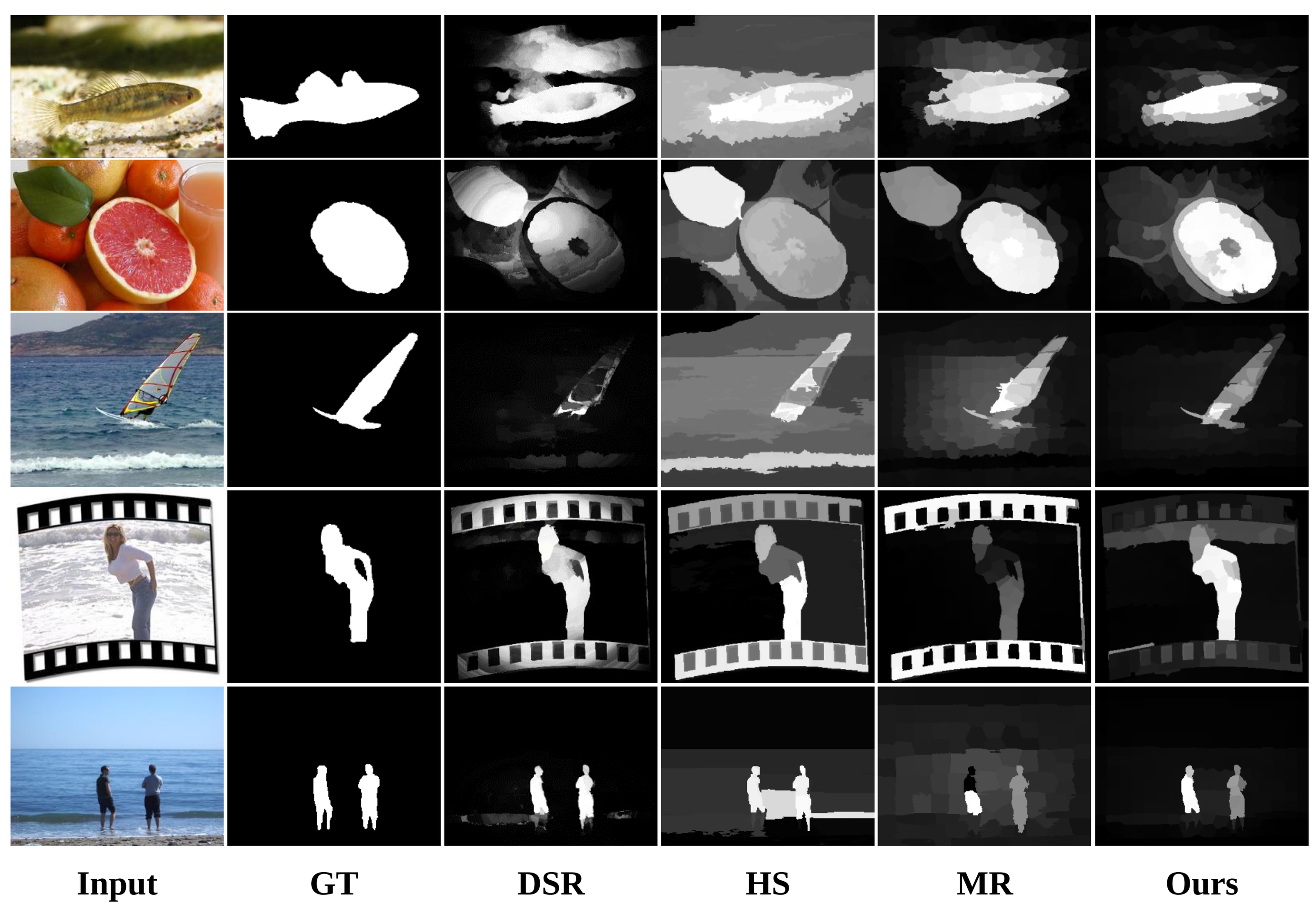
- **Performance evaluation**



X^* means combining the X method with ours, by multiplying the two saliency maps

1) Our method compares favorably with previous works
2) Ours outperforms state-of-the-art on more difficult datasets (SOD)
3) After combination, all previous methods are significantly improved
4) Performance gaps between previous methods are smaller after combination

- **Examples**



- **References**

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