Automatic and precise extraction of generic objects using saliency-based priors and contour constraints

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Summary:
- A basic method for reducing noise on automatically-segmented regions in videos is discussed in this paper.
- The first part, called the Contour-Classification Method, reduces noise by classifying contours in video frames as either object or noise.
- The second part, called the Erosion-Dilation Method, uses a combination of erosion and dilation techniques for noise reduction.
- Our proposed method is then the combination of these two fundamental techniques: Contour-Classification and Erosion-Dilation.
- Test results show that our proposed method precisely removes noisy regions from videos with a low error rate.

Improvement 1: Contour Classification Process

1. Original Images
2. Saliency Graph Cuts
3. Find contours
4. Contour classification

Case 1
Largest Contour Area Criterion
Pros: Noise is reliably removed
Cons: Don’t allow the existence of more than one object region

Case 2
Contour Area Threshold Criterion
Pros: Allows multiple regions
Cons: Hard to set an appropriate threshold between object and noise

Baseline (Saliency Graph Cuts):

Improvement 2: Erosion-Dilation Process

1. Original Images
2. Saliency Graph Cuts
3. Count the average “object” pixel “a” of each sub-region. Every sub-region overlaps neighboring sub-regions by half.

4. Erosion or dilation
   - $0 \leq a < \theta_e$ → perform erosion
   - $\theta_e \leq a \leq 1$ → perform dilation
   - $\theta_e \leq a \leq \theta_d$ → do nothing,
     ($\theta_e$: Erosion threshold)
     ($\theta_d$: Dilation threshold)

Quantitative Results

Qualitative Results

• For the tests, we used 8 videos of 7 seconds in length, running at 12 fps with a resolution of 352 x 288.
• Test program was coded in C++, using OpenCV libraries.
• For these results, the best parameters were used. The evaluation of parameter choice was not included here for brevity.

Summary:
- Contour-Classification method only removes smaller regions of noise. This is due to limitations of threshold criterion.
- Erosion-Dilation works slightly better, but has difficulty completely removing larger areas of noise.
- Combination of the two methods works the best, as it removes the noise almost entirely.