StereoSnakes: Contour Based Consistent Object Extraction For Stereo Images

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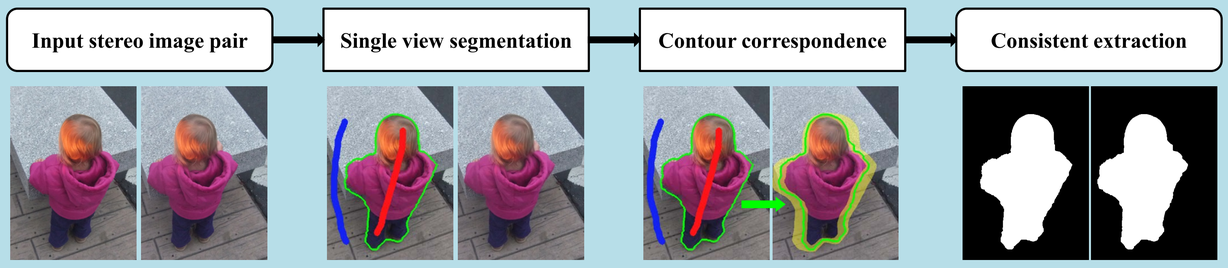
Consistent Object Extraction For Stereo Images

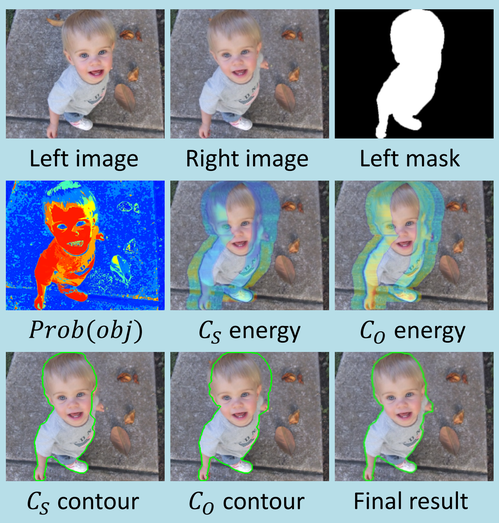
- A method for consistent object extraction in stereo images
- Search for consistent contours instead of regions
- Effortlessly make single-image segmentation methods work for stereo scenarios
- Only one view interaction
- Better accuracy and much higher efficiency
- Examples of Graph cuts (left) and GrabCut (right) combined with StereoSnakes

Framework



Given a stereo image pair, we first extract the object-of-interest on either view using single image methods (take graph cuts for example here). Next we transform the extraction result into contours and search for the corresponding contours on the other view. At last, we recover the extraction masks from the contours.

Formulation

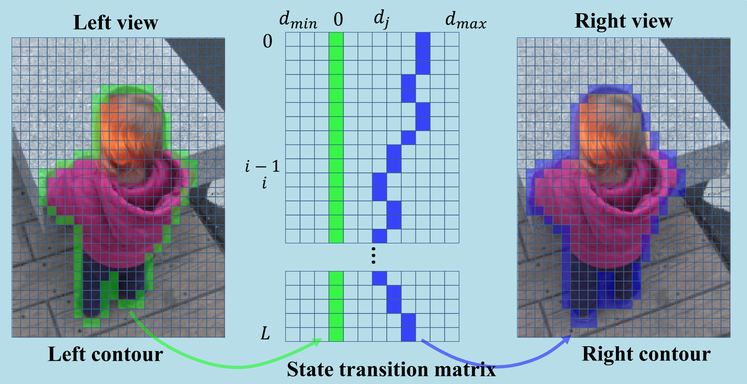


$$E(d) = \sum_{p_i \in C_m} C_S(p_i, p_i - d(p_i)) + \lambda_O C_O(p_i, p_i - d(p_i)) + \lambda_S N(p_i, p_{i-1}) \quad (1)$$

We formulate the contour correspondence as an energy minimization problem in the disparity space. $E(d)$ is the objective energy and d stands for the required disparities. C_S denotes the matching cost between corresponding. C_O stands for the object boundary cost which pulls contours towards real object boundaries. The last term is a smoothness function between adjacent pixels. λ_O and λ_S are two weighting parameters.

Algorithm

- Extract the object contour on one view, as shown in green in the left image.
- Solve (1) using dynamic programming. The state transition matrix is shown in the middle.
- Search for the minimum weight path in the state transition matrix.
- Map the minimum weight path backward to the other view.
- Extract the object mask according to the contour.



Experiments

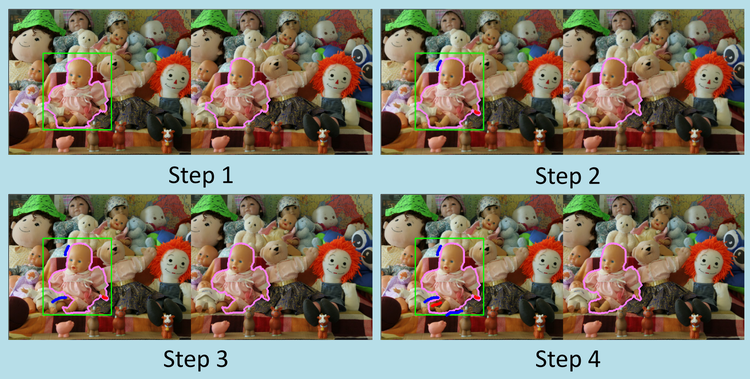
Quantitative evaluation

- Adobe open dataset including 31 stereo images and groundtruth masks
- Compared with 4 state-of-the-art methods: stereocut (ST), contour tracking (CT), cosegmentation (CO), snapcut (SN)
- Results given in mislabeled pixels and runtimes

Method	ST	CT	CO	SN	Ours
Error(#)	481	1277	2995	1094	**439**
Error(%)	0.23	0.61	1.43	0.53	**0.21**
Runtime(s)	0.650	0.413	0.532	0.715	**0.031**

Single image methods combined with our method (a)

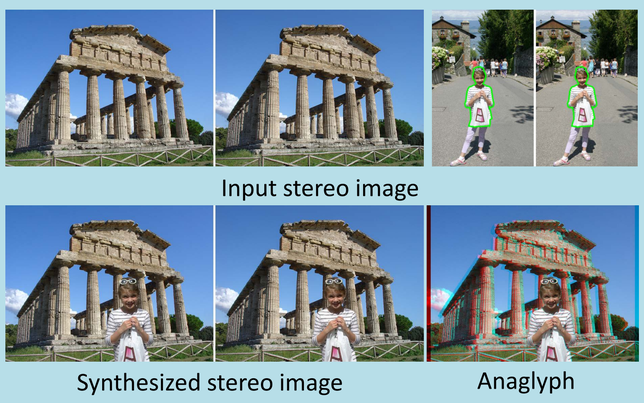
- GrabCut



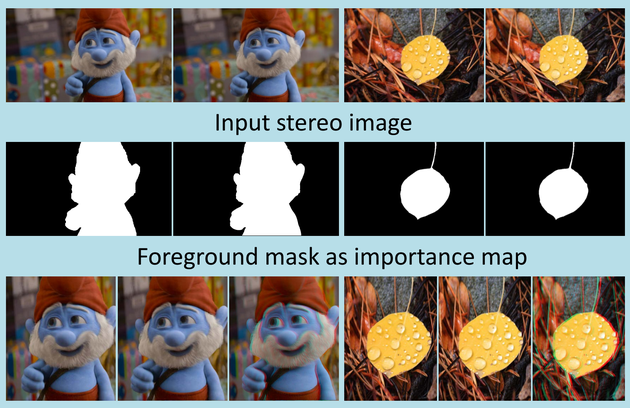
- Magnetic lasso

Applications

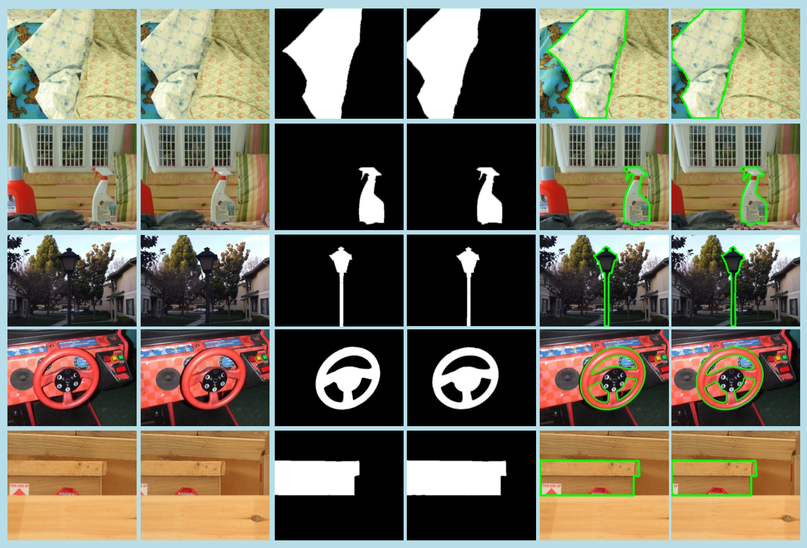
Stereo image composition



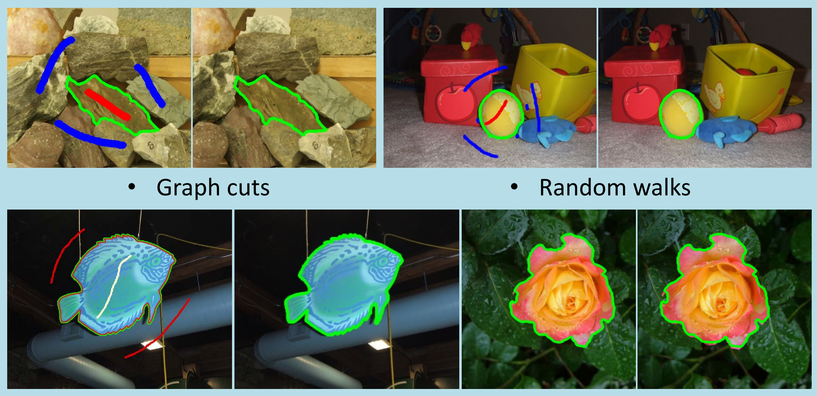
Stereo image retargeting



Examples of our results



Single image methods combined with our method (b)



- Graph cuts
- Random walks
- Geodesic star
- Branch-and-mincut

Funds

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