# Image editing and browsing

## *GrabCut*

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## Easy object cut-and-paste

***Description:*** *GrabCut* is an efficient, interactive tool for foreground segmentation in still images. For moderately difficult examples it is sufficient to mark the object with a rectangle (or lasso) to obtain the desired result. Classical image editing tools use either texture (colour) information, e.g. Magic Wand, or edge (contrast) information, e.g. Intelligent Scissors. *GrabCut* successfully combines both types of information. It extends considerably the graph-cut based segmentation technique introduced by Boykov and Jolly at ICCV 2001. First, a more powerful, iterative version of the optimisation technique has been developed. Secondly, the power of the iterative algorithm is used to simplify substantially the user interaction needed for a given quality of result. Thirdly, a robust algorithm for ``border matting'' has been developed to estimate simultaneously the alpha-matte around an object boundary and the colours of foreground pixels.

## Scientific publications

1. *C. Rother, V. Kolmogorov, A. Blake.* GrabCut: Interactive Foreground Extraction using Iterated Graph Cuts. *ACM Transactions on Graphics (SIGGRAPH'04), 2004*
2. *A. Blake, C. Rother, M. Brown, P. Perez, and P. Torr.* Interactive image segmentation using an adaptive GMMRF model. *Proc. Eur. Conf. on Computer Vision, ECCV (2004).*

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## Video & Extra Material

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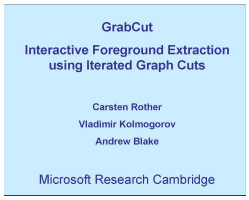
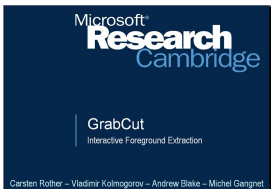
|---|---|---|---|---|
|   |   |   |   |  |
| Video | Press Talk | Poster | Siggraph 04 Talk | High Quality Images |

The Siggraph and Press talk contains many compressed images. Please contact us (carrot 'at' microsoft.com) if you need a high quality version of one of these images.

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# Ground Truth Database

To evaluate our method we designed a new ground truth database of 50 images. The following zip-files contain: Data, Segmentation, Labelling - Lasso, Labelling - Rectangle. Due to license issues, please download the following images (readme.txt) from the zip-file available at Berkley Image database. Explanation of the datasets:

Data | Segmentation | Labelling-Lasso | Labelling-Rectangle

**Segmentation:** A tri-map which specifies background (0), foreground (255) and mixed area (128). The mixed area contains pixels which are a combination of fore- and background texture. Note, in low contrast regions the true boundary is not observed and the ground truth is in this case a "good guess".
**Labelling-Lasso:** Imitates a tri-map obtained by a lasso or pen tool. The colour coding is: background (0); background - used for colour model training (64); inference (unknown) region (128); foreground - used for colour model training (255). Note, a lasso tool can be imitated by specifying the foreground region (255) as unknown (128).
**Labelling-Rectangle:** Imitates a tri-map obtained by two mouse clicks (rectangle). Same colour coding as in Labelling-Lasso.

### Benchmark results with the GMMRF model (see ECCV 04)

| Segmentation Model | Error rate (%) |
|---|---|
| GMMRF; optimally chosen gamma using ground truth (K = 10 full Gaussians) | 1.17 |
| GMMRF; discriminatively learned gamma = 50 (K = 10 full Gaussians) | 1.47 |
| Learned GMMRF parameters (K = 30 isotropic Gaussians) | 1.60 |
| GMMRF; discriminatively learned gamma = 50 (K = 30 isotropic Gaussians) | 1.71 |
| Strong interaction model (gamma = 1000; K = 30 isotropic Gaussians) | 2.07 |
| Ising model (gamma = 25; K = 30 isotropic Gaussians) | 2.03 |

| | |
|---|---|
| Simple mixture model - no interaction (gamma = 0; K = 30 isotropic Gaussians) | 3.12 |

Note, these results are different to the evaluation presented in the ECCV 04 paper (see Fig. 4). The reason is a modified database (due to license issues). Furthermore, the gamma refers to the SIGGRAPH 04 paper (see eqn. 4)

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