ATIA 2017 Opgave 1

Segmentation

Kim S. Pedersen, Søren Olsen

This is the first of three assignments of the course ***Advanced topics in Image Analysis*** **(ATIA)**. To pass the course you should hand in a final report that include your solution to all three assignments. To help you manage your time we have given deadline for each assignment and if you submit something by the deadline you might get some feedback from us. For this assignment you must upload before Monday December 11, 2017 at 23:59 to receive feedback.

This assignment is concerned with segmentation of images and specifically we will investigate how difficult it is to successfully segment into foreground and background regions. Consider images of plants like the ones you see in Figure 1. For some of these it might be easy to define what is foreground and background, but for other this is not the case.

Figur 1: We would like to segment images like this. For some of these - like the image on the left - it might be easy to define what is foreground and background, but for other this is not the case. (Middle and right) Are we interested in segments for individual leaves and flowers or do we want to identify individual plants?

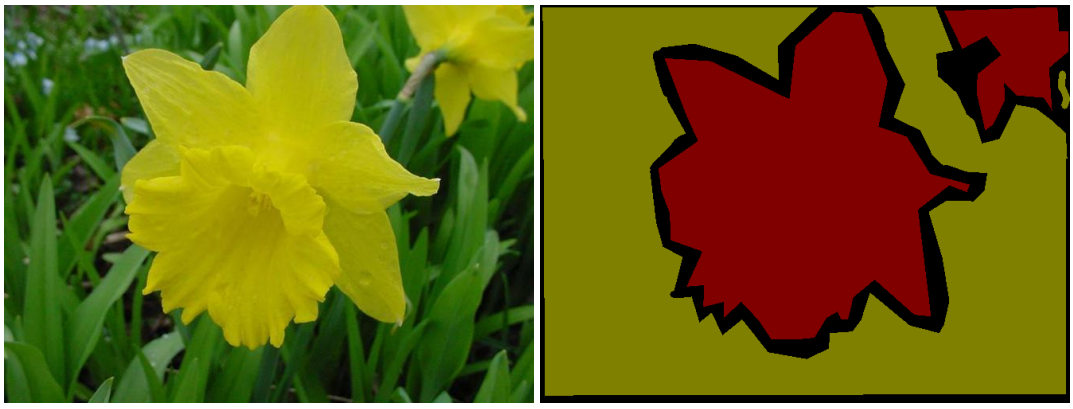
You should implement at least one of the segmentation methods [1, 2, 3] we have discussed in class, and do a study of how the parameters of the methods affect the performance of the method. To measure the performance of segmentation methods it is common to use one or more of the following metrics; F-measure of boundary points (as described in the book Section 9.5.1) or the Jaccard index of the segments. The Jaccard index measures the difference between two binary segmentation masks, A and B,

$$J(A,B) = \frac{|A \cap B|}{|A \cup B|}\,, \tag{1}$$

where $|\cdot|$ denotes cardinality of the set, or in this case, the amount of pixels in the set. The Jaccard index balances over-segmentations against under-segmentations. In this assignment A could be the outcome of your method to perform foreground-background segmentation and B could be the ideal

segmentation (also called the groundtruth) we would like our method to achieve.

In Absalon you find a couple of images you may use as examples, but for comparison you need a dataset with ground truth segmentations. We suggest that for measuring performance you use the Oxford flowers dataset (`http://www.robots.ox.ac.uk/~vgg/data/flowers/`) which includes ground truth segmentations (see Figure 2).



Figur 2: An example image from the Oxford flowers dataset with corresponding ground truth segmentation map. In the segmentation map, black pixels denotes uncertain boundary pixels - they can either be foreground or background and you could choose not to include when computing the performance metrics.

We expect that you implement at least one segmentation methods from scratch, but you are encouraged to compare the result of your implementation with results obtained from implementations of other methods, e.g. downloaded from the internet. We recommend, that in addition to commented images, you describe your problems, solutions including the necessary theory, and results in about 2-3 pages of text. Remember that you may develop and discuss your solution in groups, but you have to formulate your report individually.

Litteratur

[1] D. Comaniciu and P. Meer. Mean shift: A robust approach toward feature space analysis. *IEEE Transaction on Pattern Analysis and Machine Intelligence*, 24(5):603–629, August 2002.

[2] P. F. Felzenszwalb and D. P. Huttenlocher. Efficient graph-based image segmentation. *International Journal of Computer Vision*, 59(2):167–181, September 2004.

[3] J. Shi and J. Malik. Normalized cuts and image segmentation. *T-PAMI*, 22(8):888–905, 2000.