Image Segmentation by Graph Partitioning

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Abbreviation:	image-seg
Number of instances:	100
Number of variables:	$156 - 3764$
Number of labels:	equal to the number of variables
Number of factors:	$439 - 10970$
Order:	2
Function type:	Potts

Description Image segmentation can be understood as a graph partitioning problem w.r.t. an adjacency graph of pixels or superpixels [1, 2]. This benchmark contains the 100 graphical models described in [1], one for every test image in the Berkeley segmentation dataset [3]. Each of these models assigns an objective value to every possible partition of a given superpixel adjacency graph.

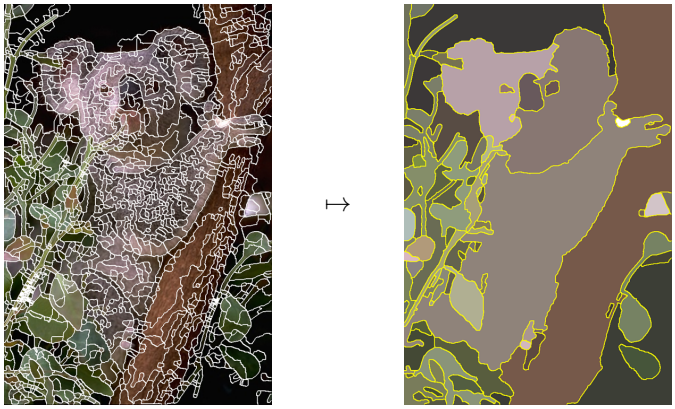

Figure 1: This benchmark contains models for segmenting superpixel segmentations of the 100 test images of the Berkeley segmentation dataset [3] by means of graph partitioning [1].

Objective / Learning For the purpose of this benchmark, these models are provided in their dual form in which there is one variable x_v for every superpixel $v \in V$. Every variable can assume as many labels as there are superpixels, i.e. labels $0, \dots, |V| - 1$.

For every pair $\{v, w\} \in E$ of superpixels which are neighbors in the superpixel adjacency graph (V, E), there is one second-order term

$$\varphi_{vw}(x_v, x_w) = \begin{cases} \theta_{vw} \in \mathbb{R} & \text{if } x_v \neq x_w \\ 0 & \text{otherwise} \end{cases} . \tag{1}$$

The parameters θ which can be positive or negative are differences of log-likelihoods that are learned independently from empirical training data as described in [1]. There are no first-order terms in the objective function

$$J(x) = \sum_{\{i,j\} \in E} \varphi_{ij}(x_i, x_j) \ . \tag{2}$$

References

[1] Björn Andres, Jörg H. Kappes, Thorsten Beier, Ullrich Köthe, and Fred A. Hamprecht. Probabilistic image segmentation with closedness constraints. In *ICCV*, 2011.

[2] Jörg H. Kappes, Markus Speth, Björn Andres, Gerhard Reinelt, and Christoph Schnörr. Globally optimal image partitioning by multicuts. In *EMMCVPR*, 2011.

[3] D. Martin, C. Fowlkes, D. Tal, and J. Malik. A database of human segmented natural images and its application to evaluating segmentation algorithms and measuring ecological statistics. In *ICCV*, 2001.