Geometric Labelling 3

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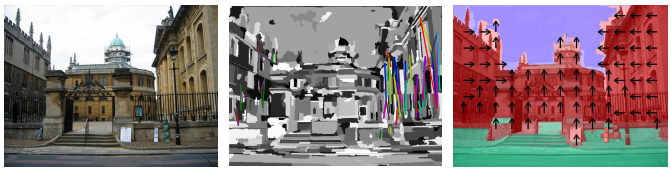
Abbreviation:	geo-surf-3
Number of instances:	300
Number of variables:	29-1133
Number of labels:	3
Number of factors:	64-3987
Order:	2 and 3
Function type:	(Shared) Dense Factor Tables

Description This dataset contains 300 instances of a geometric labelling problem, proposed by Hoiem et al. [2] and formulated as a higher-order MRF by Gallagher et al. [1]. The goal is to label each superpixel in the image as one of three classes – ground, vertical or sky. The graph-structure is an adjacency graph over superpixels.



(a) Image (b) Superpixels with vertical triplets. (c) Result.

Figure 1: Geometric Labelling.

Objective / Learning The objective function consists of unary, pairwise and triplet terms.

$$J(x) = \sum_{v \in V} \varphi_i(x_i) + w_p \sum_{(i,j) \in E} \varphi_{ij}(x_i, x_j) \quad (1)$$

$$+ w_t \sum_{(i,j,k) \in T} \varphi_i(x_i, x_j, x_k) \quad (2)$$

The unary term for each state is the negative log of the estimated probability of that superpixel belonging to that class, as output by the logistic regression Adaboost classifiers trained by Hoeim et al. [2]:

$$\varphi_i(x_i) = -\log \tilde{P}(x_i) \quad (3)$$

The edge and triplet energies are negative log co-occurance counts from the training dataset.

$$\varphi_{ij}(x_i, x_j) = -\log \tilde{P}(x_i, x_j) \quad (4)$$

$$\varphi_{ijk}(x_i, x_j, x_k) = -\log \tilde{P}(x_i, x_j, x_k) \quad (5)$$

The triplets terms consist of nearly vertical columns of superpixels and their potentials force these triplets to avoid bad labellings like – ground, sky, ground for three nearly vertical superpixels. The relative weights of the three terms were set by hand to be $w_p = w_t = 0.05$.

References

[1] Andrew C. Gallagher, Dhruv Batra, and Devi Parikh. Inference for order reduction in Markov random fields. In *CVPR*, 2011.

[2] Derek Hoiem, Alexei A. Efros, and Martial Hebert. Recovering surface layout from an image. *IJCV*, 75(1), 2007.