Image Inpainting

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Abbreviation:	mrf-inpainting
Number of instances:	2
Number of variables:	$\sim$ 50000
Number of labels:	256
Number of factors:	$\sim$ 150000
Order:	2
Function type:	(Truncated) Quadratic Smoothness

Description Image inpainting is a restoration task where given a noisy input image with missing pixels in certain regions, the goal is to denoise the image and fill in missing pixel values. Figure. 1 shows an example from Felzenszwalb and Huttenlocher [1]. Each pixel is a variable and each intensity value (0-255) is a label. Pixels are connected in a 4-connected grid.

(a) Input Image. (b) Result.

Figure 1: Image Inpainting

Objective / Learning The objective function consists of unary and pairwise:

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

The unary cost for each pixel is the squared difference between the label and the observed intensity, except in the obscured portions, where the cost is 0 for all intensities:

$$\varphi_i(x_i) = \begin{cases} (I(i) - x_i)^2 & \text{if } I(i) \text{ is known.} \\ 0 & \text{else,} \end{cases} \quad (2)$$

where $I(i)$ is the intensity of pixel i. The pairwise energy is a truncated quadratic smoothness term:

$$\varphi_{ij}(x_i, x_j) = \min\left((x_i - x_j)^2, E_{max}\right) \quad (3)$$

where $E_{max} = 200$ and $w_p = 25$ are set by hand.

References

[1] Pedro F. Felzenszwalb and Daniel P. Huttenlocher. Efficient belief propagation for early vision. *Int. J. Comput. Vision*, 70(1):41–54, October 2006.