

# Image Inpainting

April 12, 2013

*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

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.

**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.

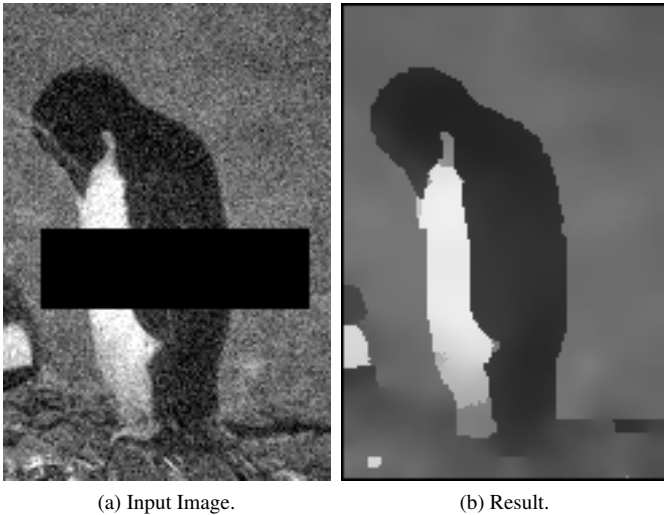


Figure 1: Image Inpainting

**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:

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