Photomontage

April 12, 2013

Abbreviation: mrf-photomontage
Number of instances: 2
Number of variables: ~500000
Number of labels: 5,7
Number of factors: ~1200000
Order: 2
Function type: Potts

Description Photomontage is a combining process of multiple photographs to form a seamless composite image [1]. Here, we perform photomontage on two benchmarks: panorama stitching and group photo merging [2] (see Figs. 1). Given n source images $S_1, \ldots, S_n$, a label x_p for each pixel p is defined such that $x_p = n$ if the pth pixel color of an output image comes from that of nth input image. The photomontage process minimizes visually noticeable seams in the composite image.

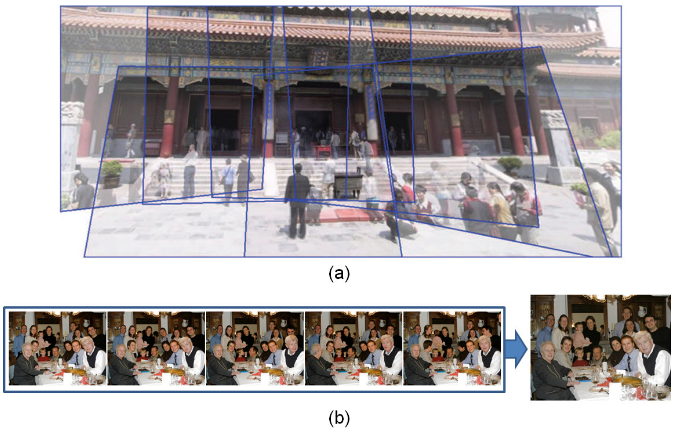

Figure 1: Photomontage benchmarks. (a) Panorama stitching. (b) Group photo merging.

Objective / Learning The energy function $J(x)$ consists of the data term $\varphi_p(x_p)$ over all pixels p and the smoothness term $\varphi_{pq}(x_p, x_q)$ over all pairs of neighboring pixels p and q.

$$J(x) = \sum_p \varphi_p(x_p) + \sum_{p,q} \varphi_{pq}(x_p, x_q) \quad (1)$$

The data term $\varphi_p(x_p)$ is defined such that $\varphi_p(x_p) = 0$ if pixel p is underneath the user-defined stroke and x_p equals the user-indicated image index, $\varphi_p(x_p) = 0$ if pixel p is not underneath the user-defined stroke and p is in the field of view of image S_{x_p}, and $\varphi_p(x_p) = \infty$ otherwise. The smoothness term is defined as

$$\varphi_{pq}(x_p, x_q) = \frac{|S_{x_p}(p) - S_{x_q}(p)| + |S_{x_p}(q) - S_{x_q}(q)|}{|\nabla_{pq} S_{x_p}| + |\nabla_{pq} S_{x_q}|}, \quad (2)$$

where $\nabla_{pq} S$ is the gradient between neighboring pixels p and q in image S. This context-dependent smoothness term encourages seams along strong edges [2].

References

[1] Aseem Agarwala, Mira Dontcheva, Maneesh Agrawala, Steven Drucker, Alex Colburn, Brian Curless, David Salesin, and Michael Cohen. Interactive digital photomontage. *ACM Transactions on Graphics*, 2004.

[2] Richard Szeliski, Ramin Zabih, Daniel Scharstein, Olga Veksler, Vladimir Kolmogorov, Aseem Agarwala, Marshall Tappen, and Carsten Rother. A comparative study of energy minimization methods for Markov random fields with smoothness-based priors. *IEEE PAMI*, 30(6):1068–1080, 2008.