Image Restoration: A Data Driven Perspective

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Outline

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Photography Images: Blind Deblurring

Real image taken by a shaking camera

Blind deblurred image

Blind deblurring

Real image taken by a shaking camera

Blind deblurred image

Blind deblurring

Cai, Ji, Liu and Shen, Blind motion deblurring using multiple images, Journal of Computational Physics, 228(14), (2009), 5057-5071.

Cai, Ji, Liu and Shen, High-quality curvelet-based motion deblurring using an image pair, CVPR, 2009.

Cai, Ji, Liu and Shen, Blind motion deblurring from a single image using sparse approximation, CVPR, 2009.
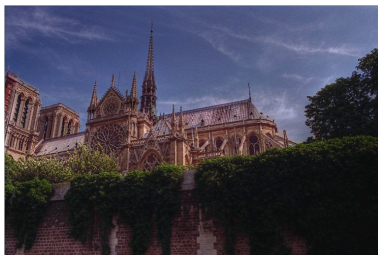
Cai, Ji, Liu and Shen, Framelet based blind motion deblurring from a single image, IEEE Transactions on Image Processing, 21(2), (2012), 562-572.

Ji, Li, Shen, Wang, Image deconvolution using a characterization of sharp images in wavelet domain, Applied and Computational Harmonic Analysis, 32(2), (2012), 295-304.

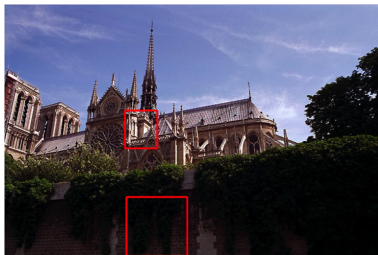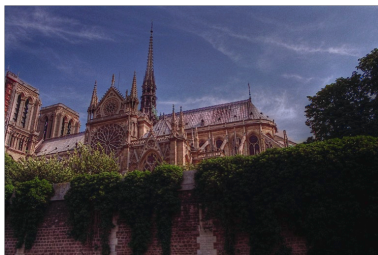# Photography Image: Recovery of over/under-exposed

Input image

Tight frame based method

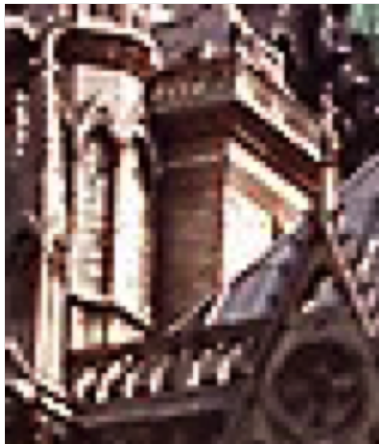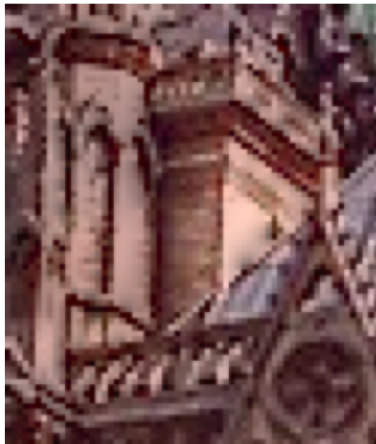# Photography Image: Recovery of over/under-exposed

Input image

Tight frame based method

Recovery of over/under-exposed regions
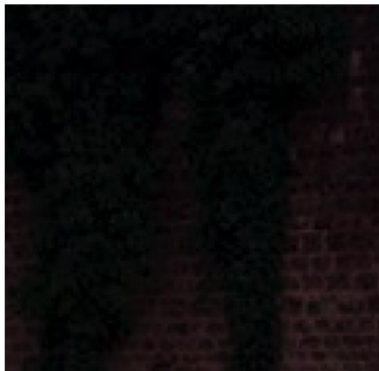
Zoom in images:

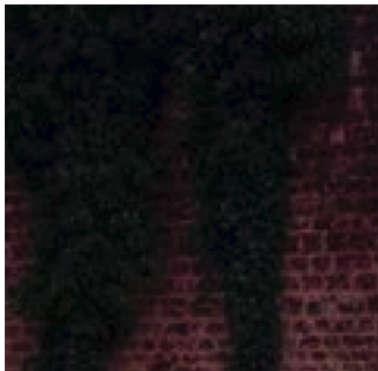Input image

Tight frame based method

Recovery of over/under-exposed regions of a single photograph

Zoom in images:

Input image   Tight frame based method

Hou, Ji and Shen, Recovering over/under-exposed regions in photographs, SIAM Journal on Imaging Sciences, 6(4), (2013), 2213-2235.

Photography Image: Image restoration with unknown noise

$$\min_{\boldsymbol{f}\in\mathbb{R}^n} \lambda_1\|\mathcal{A}\boldsymbol{f} - \boldsymbol{g}\|_1 + \frac{\lambda_2}{2}\|\mathcal{A}\boldsymbol{f} - \boldsymbol{g}\|_2^2 + \rho\|\mathcal{W}\boldsymbol{f}\|_1$$

Noisy image

Denoised image