Good Image Priors for Non-blind Deconvolution: Generic *vs* Specific

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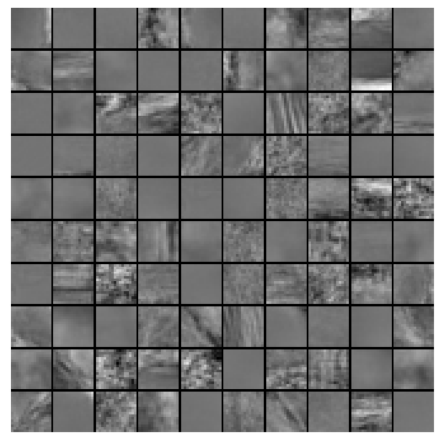
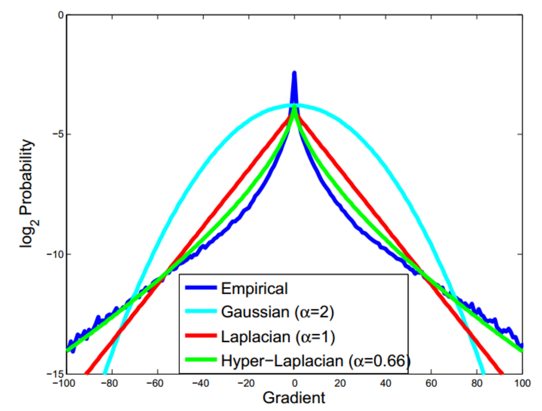
Background

Patch based priors outperform gradient based



GMM prior, Zoran & Weiss [1]



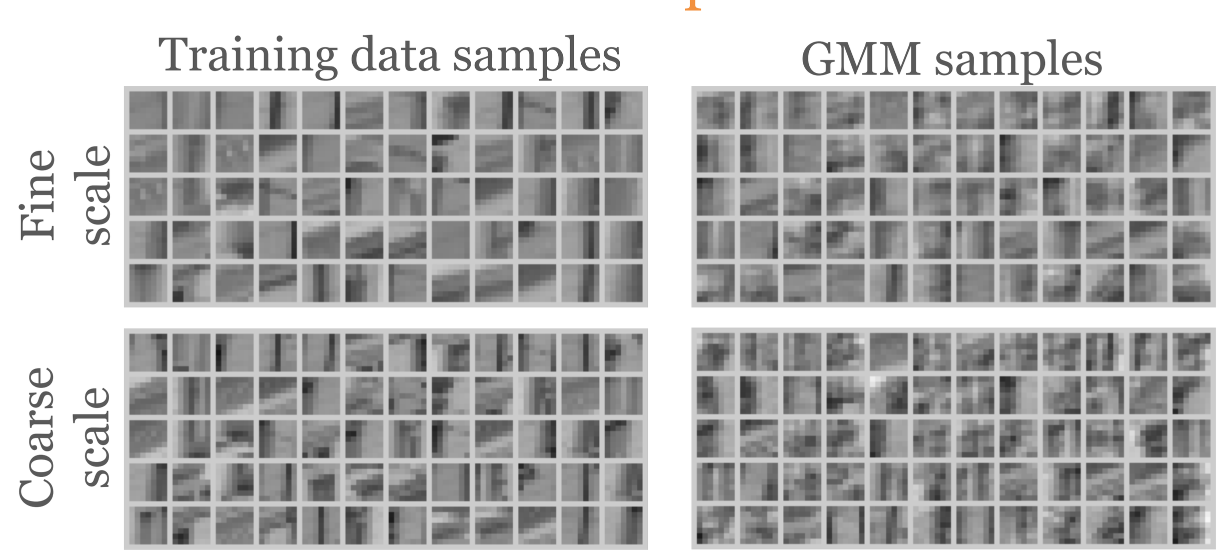
Hyper-Laplacian prior
Krishnan & Fergus[5]

Motivation

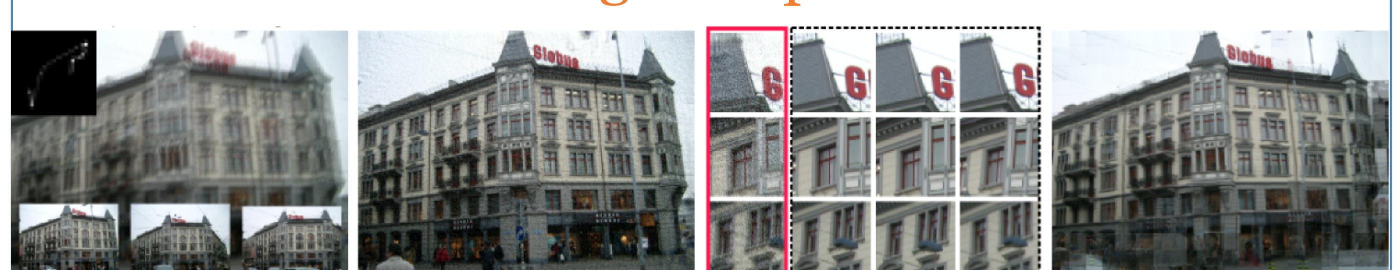
- Generic image priors **do not** benefit from having relevant training images
- Relevant example images are abundant, e.g. personal albums, Flickr, Google image search

Our Method

1. Multi-scale patch model



2. Training local prior models



Input and examples | Initial latent image | Query crop | Example crops | Overlay of best crops

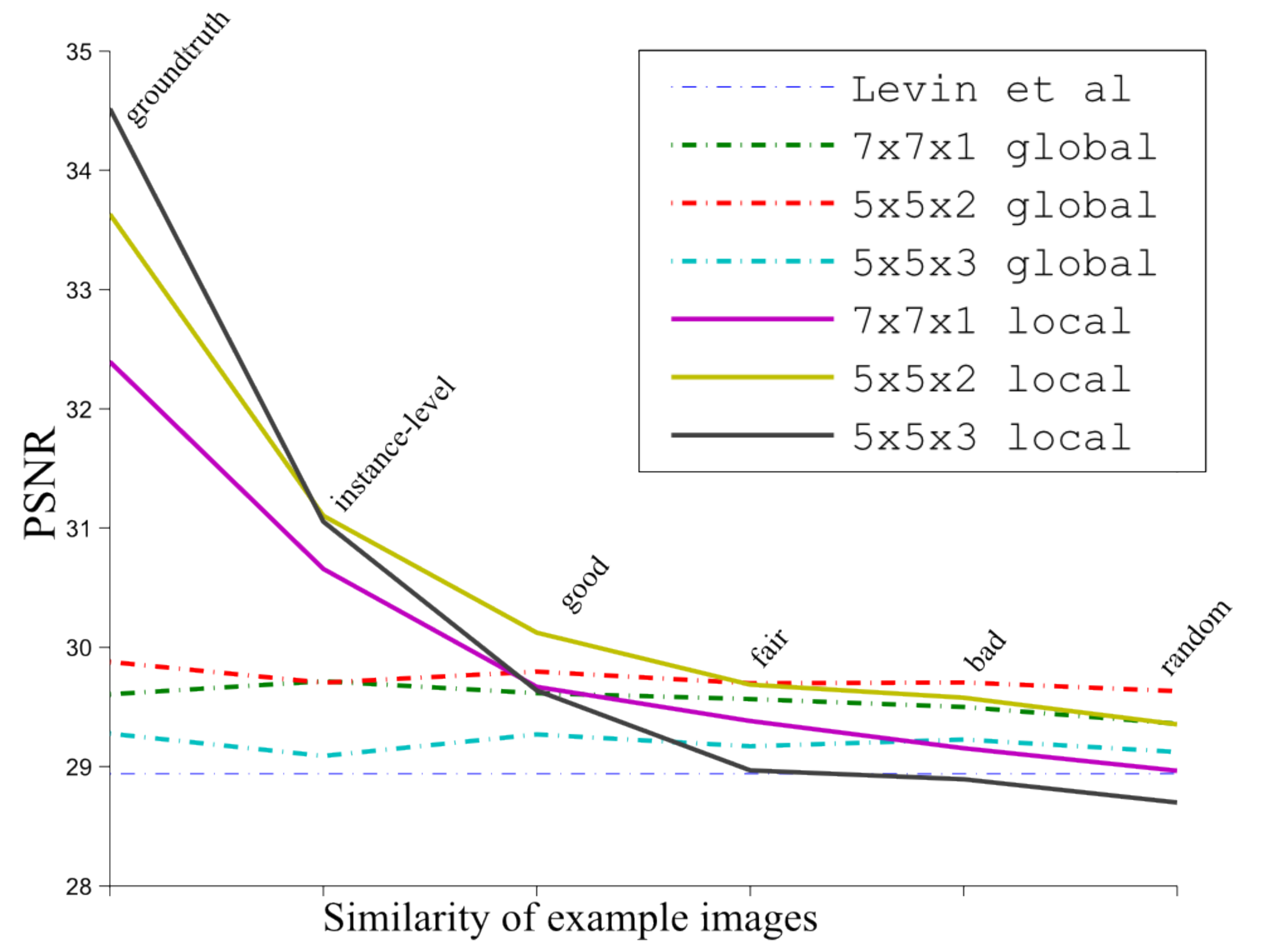
3. Iterative optimization

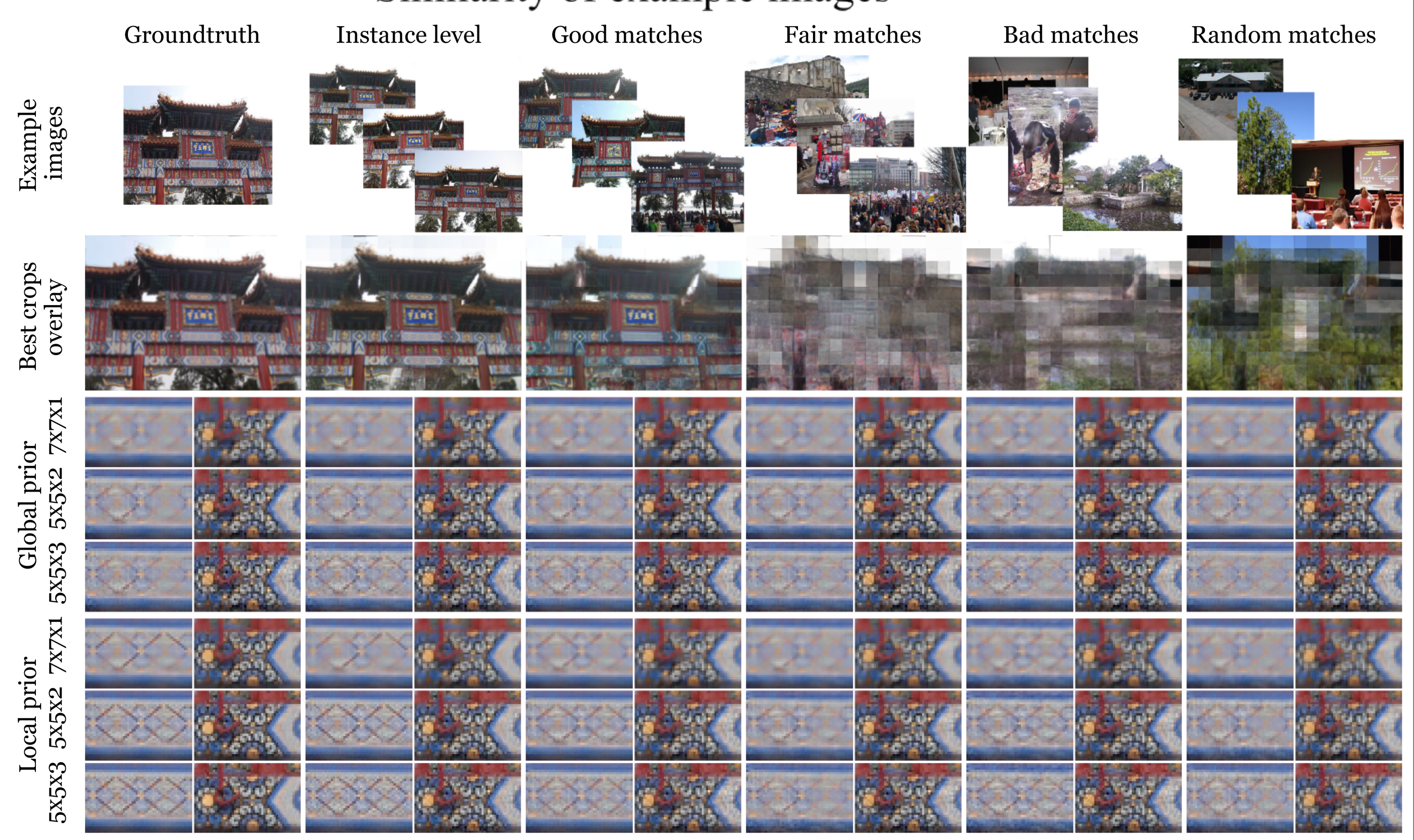
$$c_{p,\beta}(\mathbf{x},\{[\mathbf{z}]^i\}|\mathbf{y}) = \underbrace{\frac{\lambda}{2}||\mathbf{A}\mathbf{x}-\mathbf{y}||^2}_{\text{data term}} + \underbrace{\sum_i \frac{\beta}{2}(([\mathbf{x}]^i-[\mathbf{z}]^i)^T\mathbf{\Sigma}_{noise}^{-1}([\mathbf{x}]^i-[\mathbf{z}]^i))}_{\text{patch similarity term}} - \underbrace{\log p([\mathbf{z}]^i)}_{\text{prior term}}$$

X-step: update image

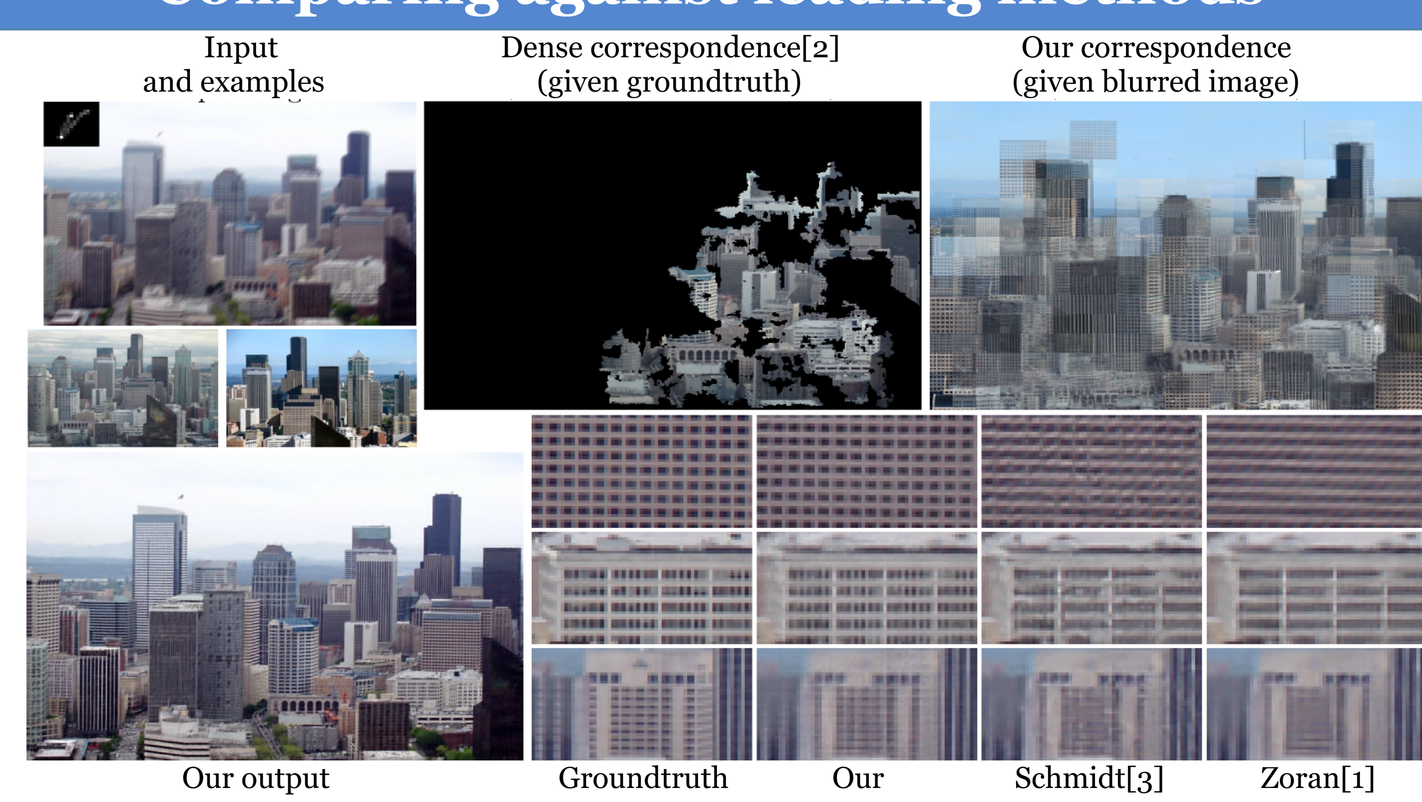
Z-step: update patches

Baseline Comparisons

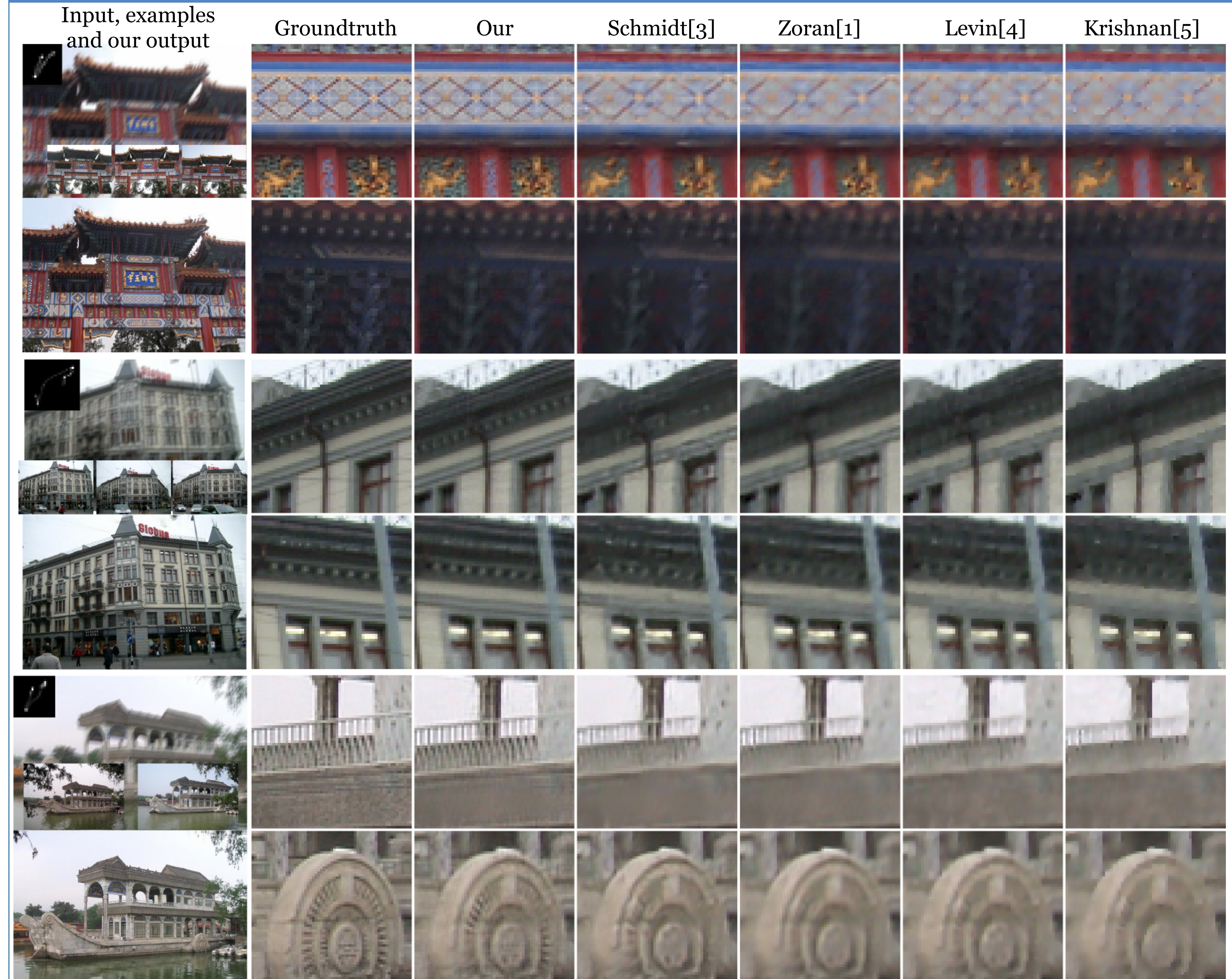




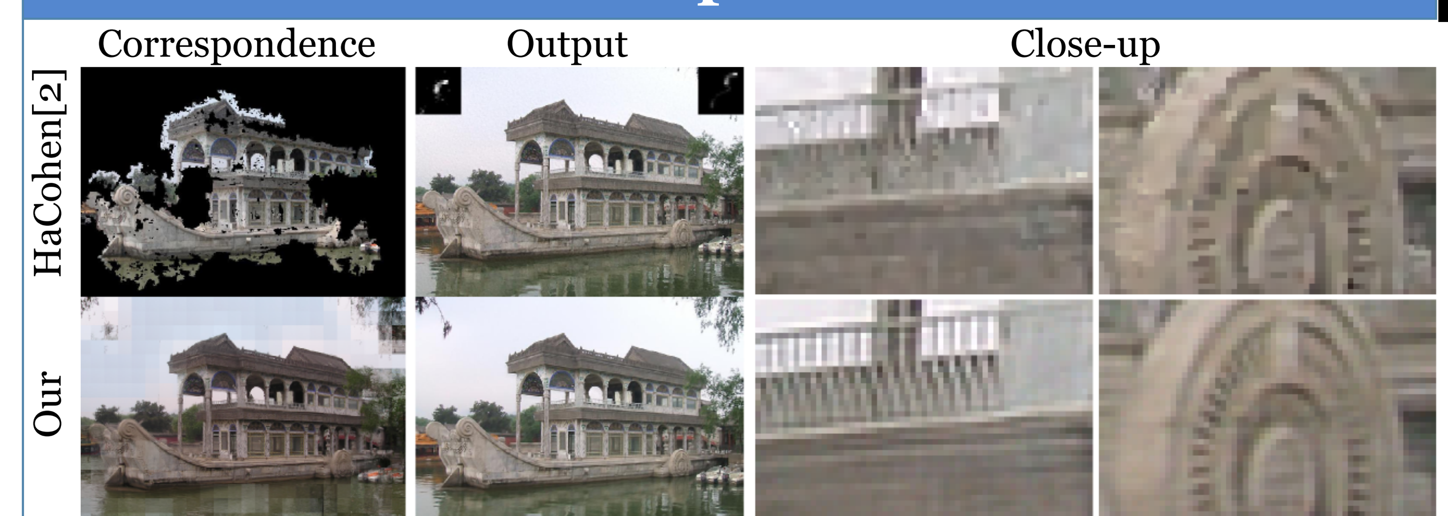
Comparing against leading methods



Results: *vs* generic methods



Results: *vs* example-based methods



Conclusions

- Global training insensitive to relevance of example images.
- Multi-scale prior recovers more image details.
- Local training + multi-scale prior yields best performance.

References

1. From learning models of natural image patches to whole image restoration. Zoran, D., Weiss, Y. ICCV 2011
2. Deblurring by example using dense correspondence. HaCohen, Y., Shechtman, E., Lischinski, D. ICCV 2013
3. Discriminative nonblind deblurring. Schmidt, U., Rother, C., Nowozin, S., Jancsary, J., Roth, S. CVPR 2013
4. Image and depth from a conventional camera with a coded aperture. Levin, A., Fergus, R., Durand, F., Freeman, W.T.. ACM ToG 2007
5. Fast image deconvolution using hyper-laplacian priors. Krishnan, D., Fergus, R. NIPS 2009

Project Page: cs.brown.edu/~lbsun/goodpriors.html