

# Fast Image Deconvolution using Hyper Laplacian Priors

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- Hyper-laplacian priors are good models of gradient distributions in natural images
  - Used in deblurring, denoising, super-resolution etc.

- Consider the deconvolution problem with sparse gradient prior ( $\alpha < 1$ ). Want  $\mathbf{x}$ , given blurry  $\mathbf{y}$  and kernel  $k$

$$\min_{\mathbf{x}} \underbrace{\sum_{i=1}^N \left( \frac{\lambda}{2} (\mathbf{x} \oplus k - \mathbf{y})_i^2 \right)}_{\text{Likelihood}} + \underbrace{\sum_{j=1}^J |(\mathbf{x} \oplus f_j)_i|^\alpha}_{\text{Prior}}$$

- Existing methods slow: ILRS takes  $\sim 1$ hr for 1 megapixel image

## Our approach:

- Splitting mechanism gives 2 sub-problems:
  - (i) quadratic in  $\mathbf{x} \rightarrow$  solve with FFT
  - (ii) 1-D problem in auxiliary  $\mathbf{w} \rightarrow$  Solve with look-up table
- Achieve *2-3 orders of magnitude* speed-up over IRLS

