Odstraňování artefaktů při dekonvoluci

vylepšení funkce *edgetaper*

Filip Šroubek
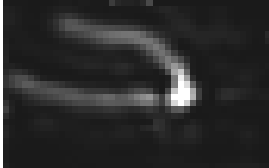
Chaoqun Dong and Javier Portilla

Motion Blur
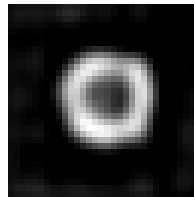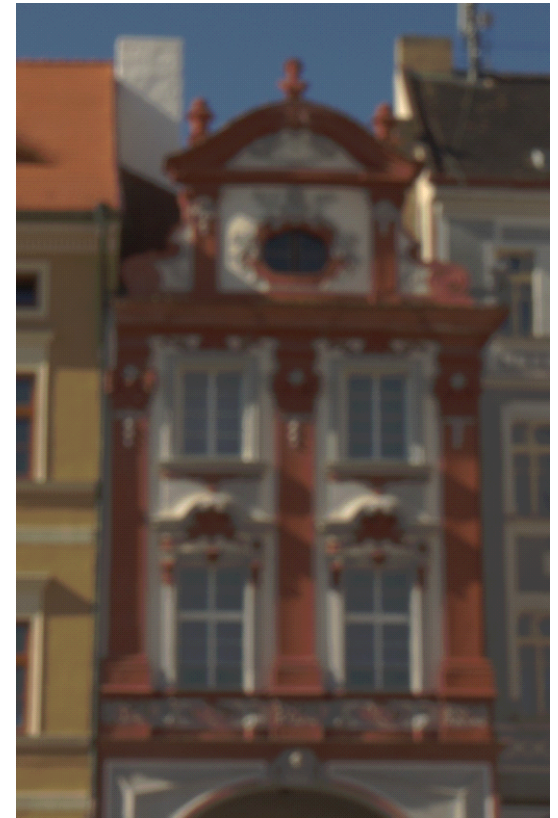
Out-of-focus Blur
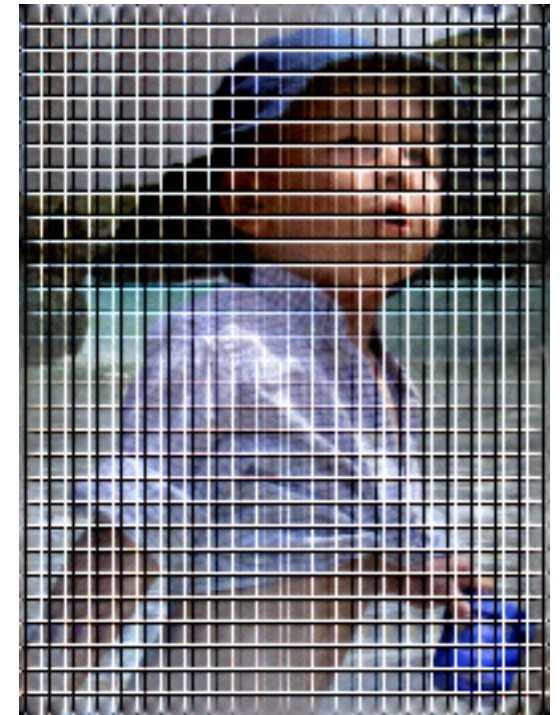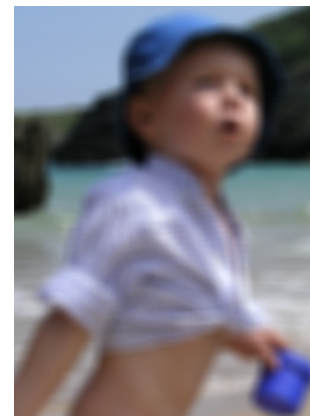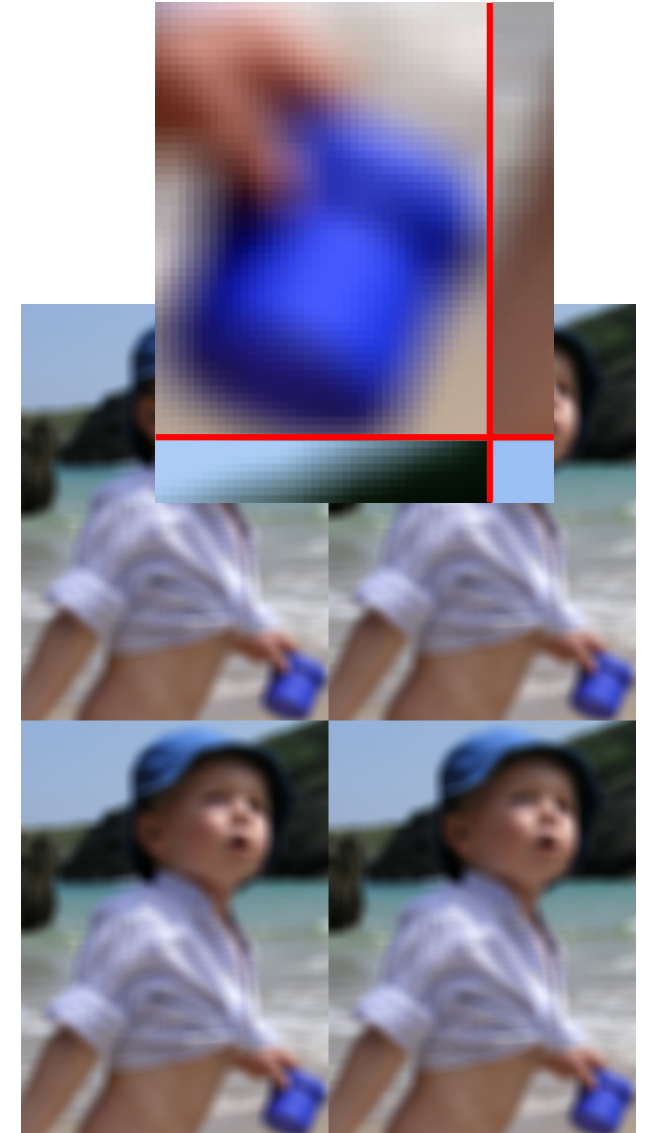
Deconvolution

Original image

Blurred captured image

deconwnr.m (Wiener filter)

Convolution Boundary Conditions

Convolution Theorem

- Convolution is pixel-wise multiplication in the Fourier domain

- Fast Fourier Transformation (FFT)

- FFT assumes periodic signal

- FFT is used in most of the deconvolution algorithms
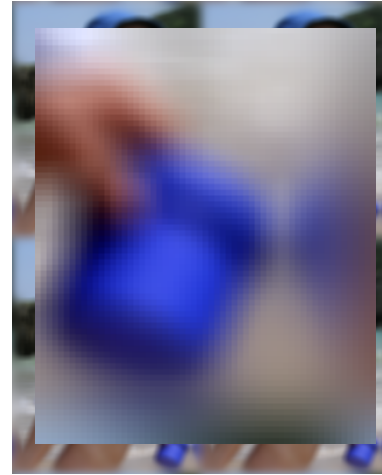
    MATLAB: deconvwnr, deconvreg a deconvlucy
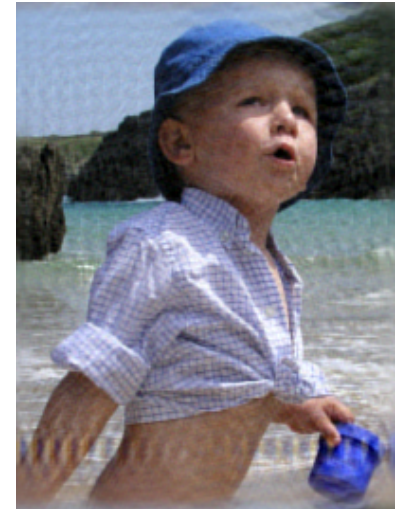

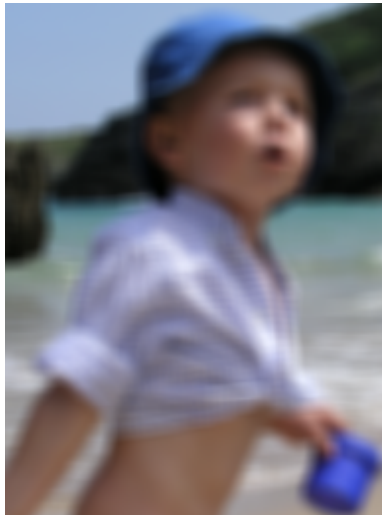- Main Idea:

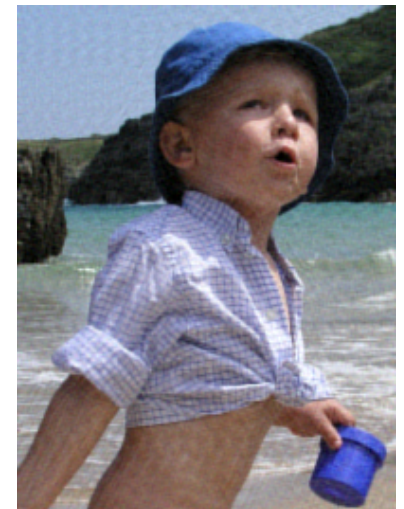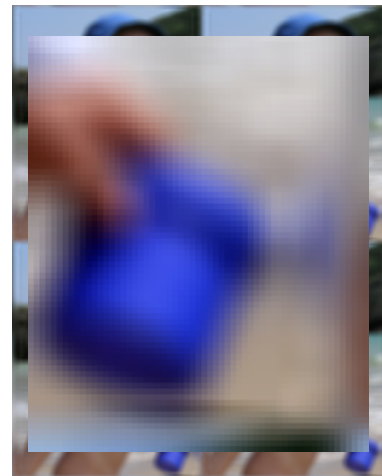   Extend the image so to make it periodic

Image Boundary Extension

edgetaper.m

deconvolution
deconwnr.m

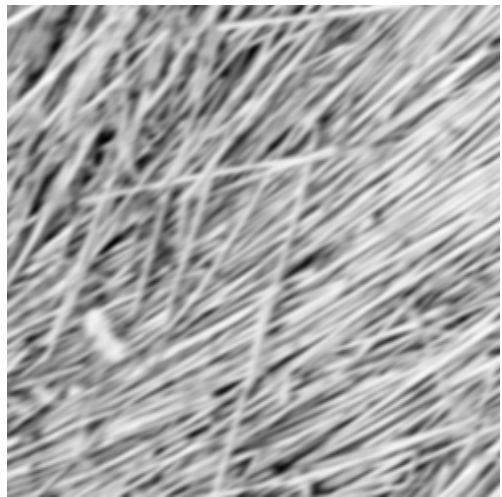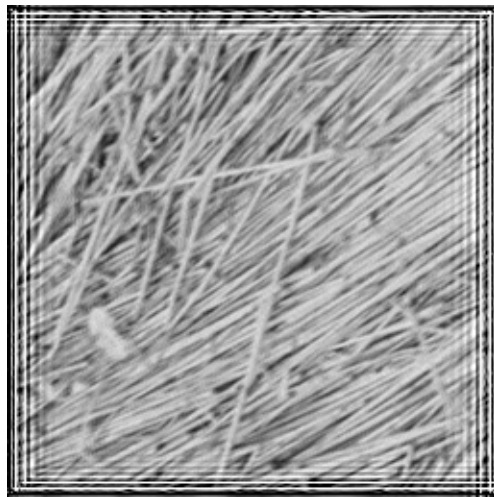proposed SPA

Blurred
input image

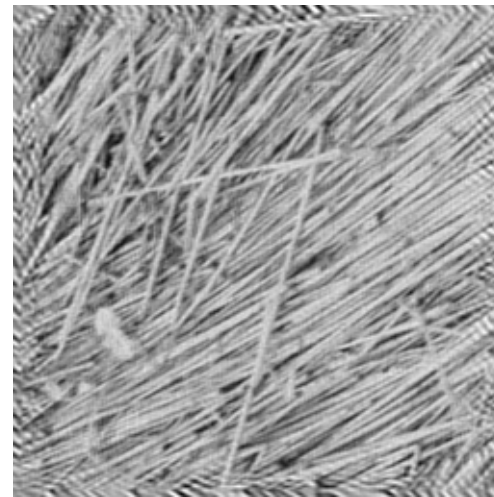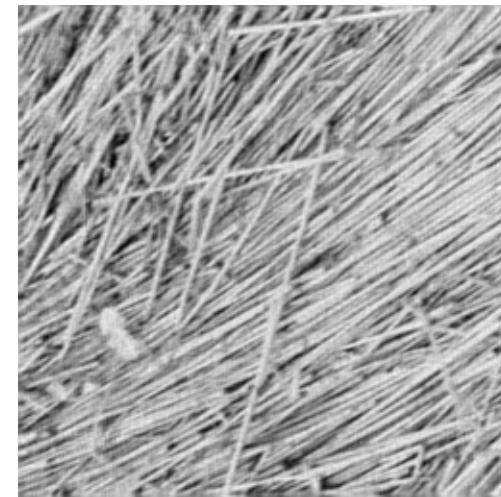**Blurred
input image**

none

edgetaper.m

proposed SPA

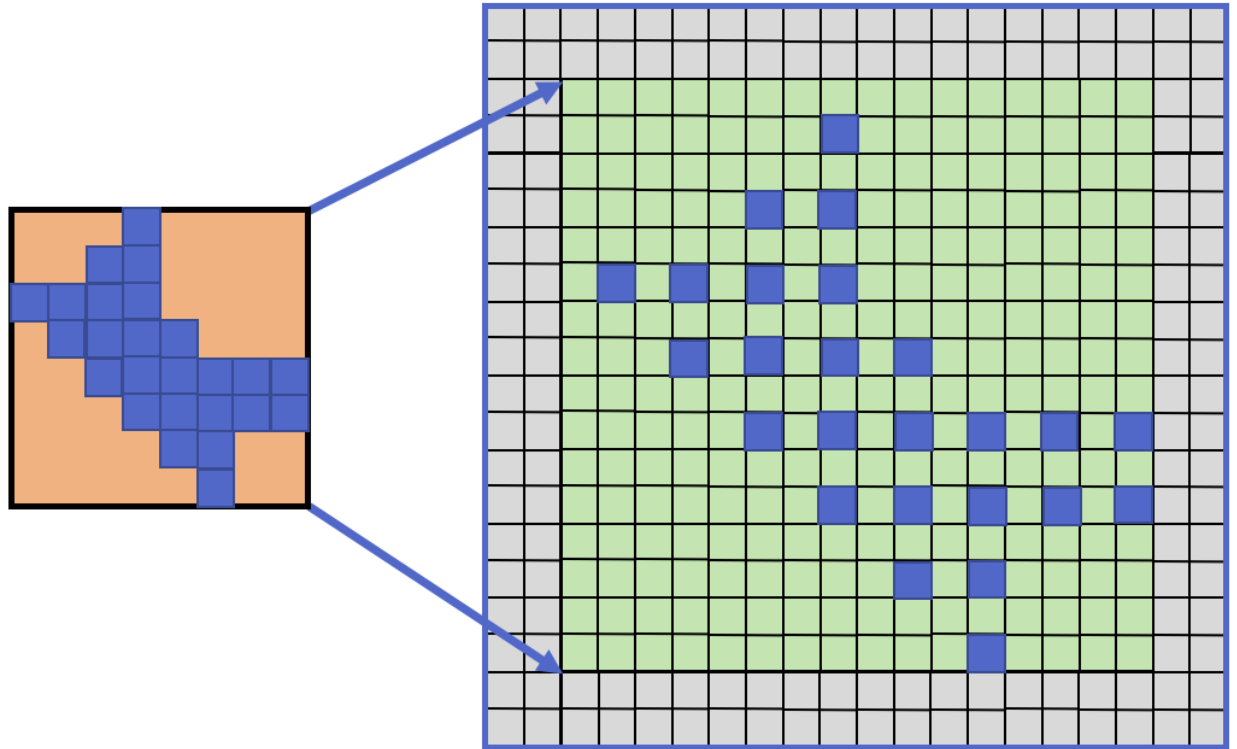# Spectral Pre-Adaptation (SPA)

- Input:
  - blurred image
  - blur
  - signal-to-noise ratio
  - mask

- Output:
  - pre-processed image ready for deconvolution
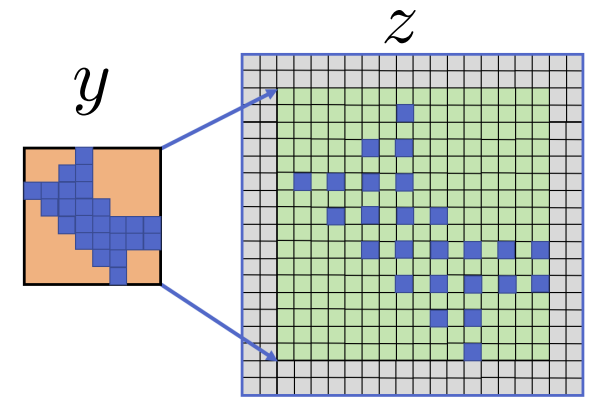
SPA

- Circular-convolution model

$$z = \mathbf{H}x + n$$

- Optimization problem

$$\min_{z} z^T \mathbf{C}^{-1} z \quad \text{s.t.} \quad z(\blacksquare) = y$$

$$\mathbf{C} = \mathbf{H}^T \mathbf{C}_x \mathbf{H} + \mathbf{C}_n$$

Aliasing-aware Restoration

Low-resolution
Input image

Restoration +
Interpolation

Interpolation +
Restoration

SPA +
Restoration

SPA versus Edgetaper

- Pros:
  - More versatile
  - Better performance
- Cons:
  - 20x slower: 256x256 image

	edgetaper	SPA
256x256	0.005s	0.1s
1024x1024	0.04s	1.2s

Thank You

- Main authors: Chaoqun Dong and Javier Portilla

- Paper, demo and MATLAB code available online:
  - Image Processing On Line (IPOL), 12 (2022)
  - https://www.ipol.im/pub/art/2022/385/