CS 663 : Digital Image Processing : Assignment 2

Siddharth Saha [170100025], Tezan Sahu [170100035]

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Question 3: Edge-preserving Smoothing using Patch-Based Filtering

For all the images

- We consider windows of 25×25 around each pixel
- We use patches of 9×9 for comparisons
- Before running the patch-based filtering algorithm, we pad the images with $floor(\frac{25}{2}) + floor(\frac{9}{2})$ pixels using *Neumann Boundary Condition* to account for edge and corner pixels
- For `barbara.mat`, to reduce the time taken for the filtering process, we downsize the image by a factor of 2 after applying a smoothing Gaussian of size = 5 and $\sigma = \frac{2}{3}$

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- For `barbara.mat`:

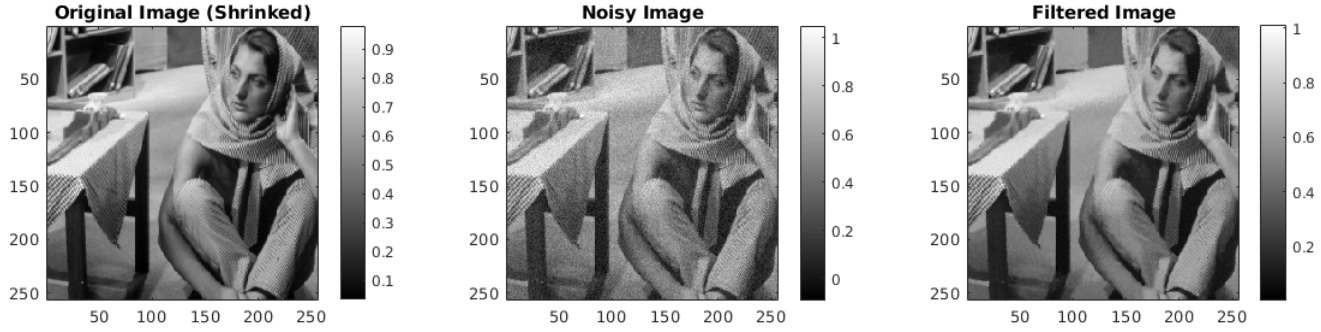

Figure 1: Patch-Based Filtering applied to corrupted `barbara.mat` (shrinked by factor of 2)

Optimal $\sigma_{intensity}$: 0.14

Optimal RMSD: 0.0272

Other RMSD Values:

i $0.9 * \sigma_{intensity}$: 0.0276

ii $1.1 * \sigma_{intensity}$: 0.0276

- For `grass.png`:

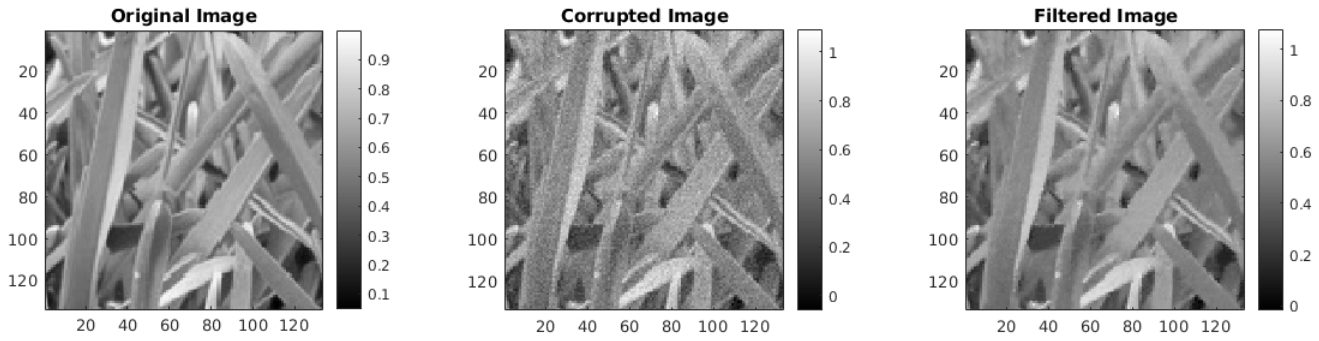

Figure 2: Patch-Based Filtering applied to corrupted `grass.png`

Optimal $\sigma_{intensity}$: 0.13

Optimal RMSD: 0.0293

Other RMSD Values:

i $0.9 * \sigma_{intensity}$: 0.0299

ii $1.1 * \sigma_{intensity}$: 0.0296

- For `honeyCombReal.png`:

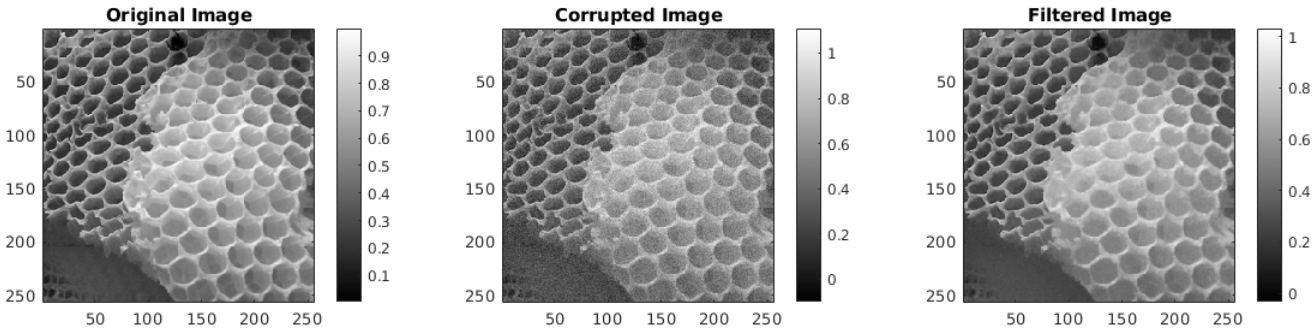

Figure 3: Patch-Based Filtering applied to corrupted `honeyCombReal.png`

Optimal $\sigma_{intensity}$: 0.16

Optimal RMSD: 0.0292

Other RMSD Values:

i $0.9 * \sigma_{intensity}$: 0.0293

ii $1.1 * \sigma_{intensity}$: 0.0309

- **Gaussian Mask used to make patches isotropic**

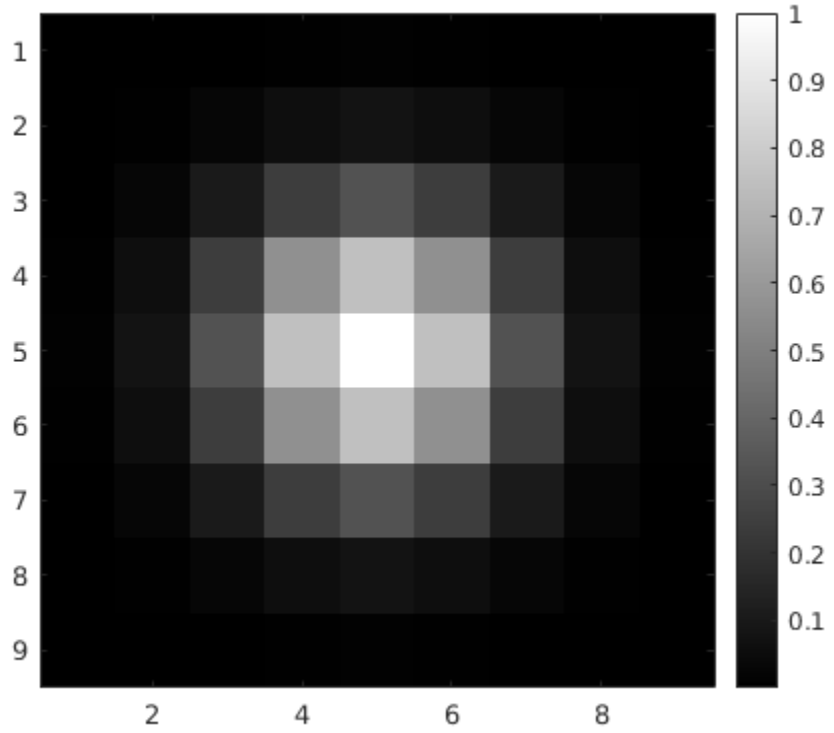

Figure 4: Gaussian Mask used to make patches isotropic with $\sigma_{spatial} = \frac{4}{3}$