Edge-preserving Smoothing using Patch-Based Filtering

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Objectives:

- Apply the patch based filtering
- Calculate and minimize the RMSD

Variables and Parameters

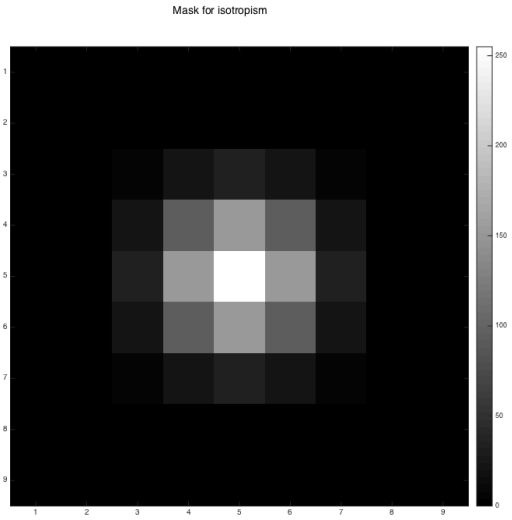
```
isotropize = 1.0;
factor = 2;
patch_size = 9;
window_size = 25;
addpath('../../common/');
load '../data/barbara.mat';
input_image = imageOrig;
sigmaOptimal = 1.62;
```

Gaussian Mask

```
gaussian_mask = fspecial('gaussian',...
    [patch_size, patch_size], isotropize);
[rows, cols] = size(gaussian_mask);
gaussian_mask_stretched = myLinearContrastStretching(gaussian_mask);
images = zeros(rows, cols, 1);
images(:, :, 1) = gaussian_mask_stretched;
```

Mask used to make images Isotropic

```
myShowImages(images, 'Mask for isotropism');
```



Subsampling Image with gaussian blur of std 0.66

```
input_image = input_image(1:factor:size(input_image, 1),...
    1:factor:size(input_image, 2));
gaussian_filter = fspecial('gaussian', [3, 3], 0.66);
input_image = imfilter(input_image, gaussian_filter);
[rows, cols] = size(input_image);
```

Noisy Image

```
noisy_image = myGaussianNoiser(input_image);
rmsd_with_noisy_image = myRMSDofImage(input_image, noisy_image);
disp(['RMSD with noisy image = ', num2str(rmsd_with_noisy_image)]);
```

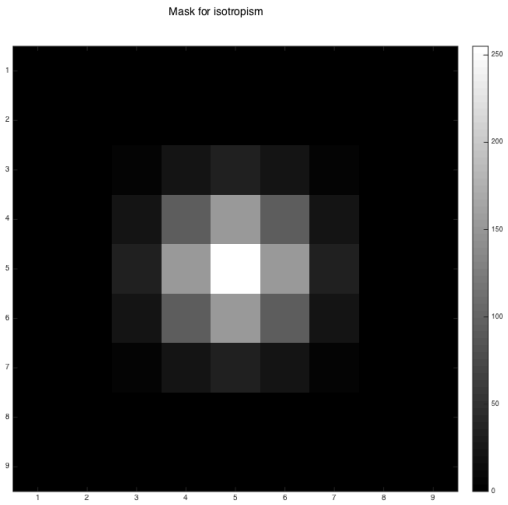
RMSD with noisy image = 4.7107

Smoothening image

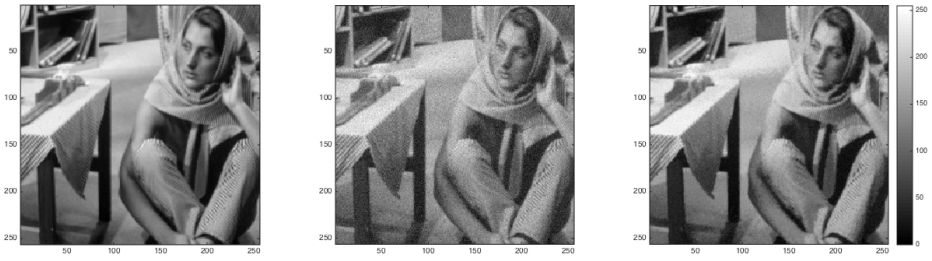
```
tic;
output_image = myPatchBasedFiltering(noisy_image, patch_size,...
    window_size, sigmaOptimal, gaussian_mask);
elapsed_time = toc;
if elapsed_time > 300
    save('../images/barbara_patch_optimal.mat', 'output_image')
end

images = zeros(rows, cols, 3);
images(:, :, 1) = myLinearContrastStretching(input_image);
images(:, :, 2) = myLinearContrastStretching(noisy_image);
```

```
images(:, :, 3) = myLinearContrastStretching(output_image);
myShowImages(images,...
    'Side by Side comparison of original, noisay and smooth barbara');

images = zeros(rows, cols, 1);
images(:, :, 1) = myLinearContrastStretching(input_image);
myShowImages(images, 'Original barbara');

images = zeros(rows, cols, 1);
images(:, :, 1) = myLinearContrastStretching(noisy_image);
myShowImages(images, 'Noisy barbara');

images = zeros(rows, cols, 1);
images(:, :, 1) = myLinearContrastStretching(output_image);
myShowImages(images, 'Smooth barbara');

optimal_RMSD = myRMSDofImage(input_image, output_image);
disp(['RMSD with optimal output = ', num2str(optimal_RMSD)]);
disp(['Optimal sigma = ', num2str(sigmaOptimal)]);
```

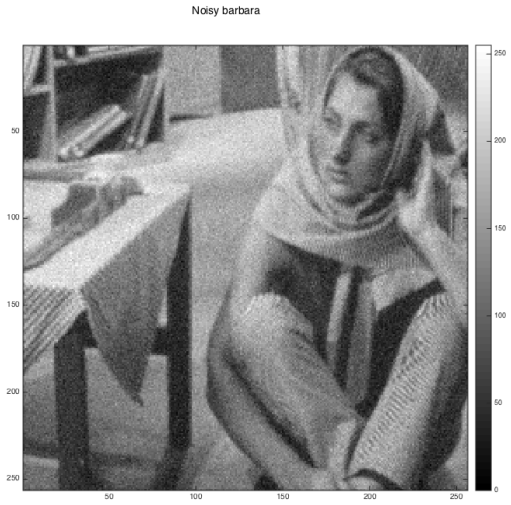
```
RMSD with optimal output = 2.6774
Optimal sigma = 1.62
```



Side by Side comparison of original, noisay and smooth barbara



Original barbara



Tweaked Parameters

RMSD with 0.9 sigmaOptimal

```
tic;
output_image_1 = myPatchBasedFiltering(noisy_image, patch_size,...
    window_size, 0.9*sigmaOptimal, gaussian_mask);
elapsed_time = toc;
if elapsed_time > 300
    save('../images/barabara_01.mat', 'output_image_1')
end
new_RMSD = myRMSDofImage(input_image, output_image_1);
disp(['RMSD with 0.9*sigmaOptimal output = ', num2str(new_RMSD)]);
```

```
RMSD with 0.9*sigmaOptimal output = 2.7571
```

RMSD with 1.1 sigmaOptimal

```
tic;
output_image_2 = myPatchBasedFiltering(noisy_image, patch_size,...
    window_size, 1.1*sigmaOptimal, gaussian_mask);
elapsed_time = toc;
if elapsed_time > 300
    save('../images/barabara_02.mat', 'output_image_2')
end
new_RMSD = myRMSDofImage(input_image, output_image_2);
disp(['RMSD with 1.1*sigmaOptimal output = ', num2str(new_RMSD)]);
```

```
RMSD with 1.1*sigmaOptimal output = 2.6406
```

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