# Sample 3-5

# 平滑化/先鋭化処理

境界処理

画像処理特論

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動作確認: MATLAB R2020a

# Image smoothing/sharpening

Boundary operation

Advanced Topics in Image Processing

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Verified: MATLAB R2020a

### 配列のパディング

(Pad array)

- · Zero padding
- Periodic extension
- · Symmetric extension

```
% Pad size setting
padsize = 2;
%
A = randi(8,4)
```

```
A = 4 \times 4
6 1 6 3
6 4 4 1
8 1 6 3
```

```
% Zero padding
B = padarray(A,[padsize padsize],0,'both')
```

```
B = 8 \times 8
                                0
                                      0
                                           0
    0
         0
               0
                     0
                          0
                                0
                                     0
                                           0
         0
              6
                     1
                                3
                                     0
         0
              6
                                1
                         6
         0
              8
                     1
                               3
                                     0
                                           0
                         2
    0
         0
               2
                                2
                                     0
                     6
                                           0
                          0
                                     0
    0
          0
               0
                                0
                                           0
                                0
```

#### % Periodic extension

```
C = padarray(A,[padsize padsize],'circular','both')
C = 8 \times 8
         3
              8
                        6
                              3
                                   8
                                        1
    6
                   1
    2
         2
              2
                   6
                        2
                              2
                                   2
                                        6
         3
                   1
                        6
                                   6
                                        1
    6
              6
                              3
                        4
    4
         1
              6
                   4
                                   6
                                        4
                             1
    6
              8
                  1
                       6 3
                                        1
         3
                                   8
    2
         2
              2
                   6
                       2
                                   2
                            2
                                        6
         3
                   1
                                        1
                                        4
```

```
% Symmetric extension
D = padarray(A,[padsize padsize],'symmetric','both')
```

```
D = 8 \times 8
   4
       6
           6
               4
                   4
                       1
                           1
                               4
   1
       6
           6
               1
                   6
                       3
                           3
                                6
   1
       6
               1
                   6
                           3
                               6
           6
                       3
                   4
                               4
   4
       6
           6
               4
                           1
                       1
   1
       8 8 1 6 3 3
                               6
       2 2 6 2 2
   6
                           2
                               2
           2
               6 2 2
                           2
       2
                               2
```

### サンプル画像の準備

(Preparation of sample image)

本サンプルで利用する画像データを収めた data フォルダにパスをとおす。

Create a path to the data folder that contains images used in this sample.

```
addpath('./data')
close
% Reading original image
I = im2double(imread('barbaraFaceRgb.tif'));
figure(1)
imshow(I)
title('Original')
```



#### フィルタの設定

(Filter setting)

```
% Filter setting
hsize = 3;
f = fspecial('average',hsize);
```

# 零值拡張

(Zero padding)

```
% Zero padding
Jz = imfilter(I,f);

% Show result
figure(2)
imshow(Jz)
title('After filtering (zero padding)')
```



# 周期拡張

(Periodic extension)

```
% Periodic extension
Jp = imfilter(I,f,'circular');

% Show result
figure(3)
imshow(Jp)
title('After filtering (periodic extension)')
```

After filtering (periodic extension)



# 対称拡張

(Symmetric extension)

```
% Symmetric extension
Js = imfilter(I,f,'symmetric');

% Show result
figure(4)
imshow(Js)
title('After filtering (symmetric extension)')
```





# 結果の比較

(Comparison)

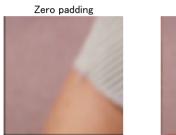
```
% Patch size
psize = 64;

% Zero padding
figure(5)
subplot(1,3,1)
imshow(Jz(end-psize+1:end,1:psize,:))
title('Zero padding')

% Periodic extension
subplot(1,3,2)
```

```
imshow(Jp(end-psize+1:end,1:psize,:))
title('Periodic extension')

% Zero padding
subplot(1,3,3)
imshow(Js(end-psize+1:end,1:psize,:))
title('Symmetric extension')
```







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