Sample 3-3

平滑化／先鋭化処理

勾配フィルタ

画像処理特論

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動作確認: MATLAB R2023a

Image smoothing/sharpening

Gradient filter

Advanced Topics in Image Processing

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Verified: MATLAB R2023a

サンプル画像の準備

(Preparation of sample image)

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

フィルタカーネルの選択

(Selecting the filter kernel)

- Sobel
- Prewitt

```
ftype = 'Sobel';
```

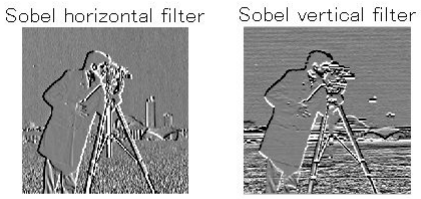
勾配フィルタ

(Gradient filter)

$$\nabla x = \begin{pmatrix} \frac{\partial x}{\partial p_{\mathrm{v}}} \\ \frac{\partial x}{\partial p_{\mathrm{h}}} \end{pmatrix}$$

```
% Gradient flter
[Gh,Gv] = imgradientxy(I,ftype);

% Show result in the horizontal direction
figure(2)
subplot(1,2,1)
imshow(Gh+.5)
title([ftype ' horizontal filter'])
% Show result in the vertical direction
subplot(1,2,2)
imshow(Gv+.5)
title([ftype ' vertical filter'])
```



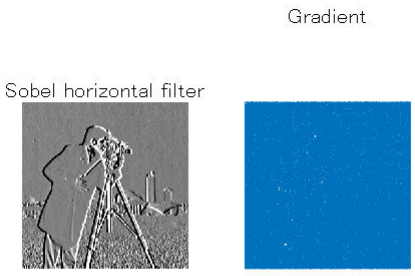
勾配の可視化

(Visualization of gradient)

$$\nabla x = \begin{pmatrix} \frac{\partial x}{\partial p_{\mathrm{v}}} \\ \frac{\partial x}{\partial p_{\mathrm{h}}} \end{pmatrix}$$

```
% Gradient
figure(3)
quiver(Gh,Gv)
title('Gradient')
axis equal
```

```
axis off
axis ij
```



勾配の大きさと方向

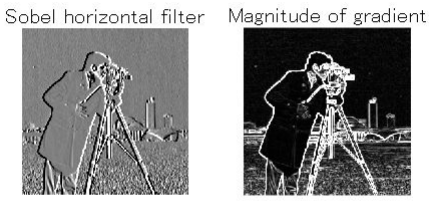
(Magnitude and direction of gradient)

$$|\nabla x| = \sqrt{\left(\frac{\partial x}{\partial p_{\mathrm{v}}}\right)^2 + \left(\frac{\partial x}{\partial p_{\mathrm{h}}}\right)^2}$$

$$\angle \nabla x = \tan^{-1} \frac{\left(\frac{\partial x}{\partial p_{\mathrm{v}}}\right)}{\left(\frac{\partial x}{\partial p_{\mathrm{h}}}\right)}$$

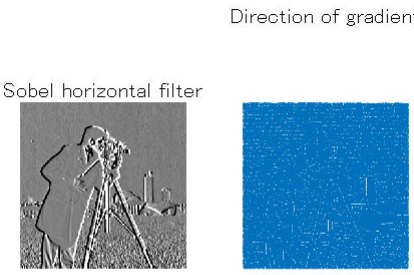
```
% Magnitude and direction of the gradient image
[Gm,Gd] = imgradient(Gh,Gv);

% Show result of magnitude
figure(4)
imshow(Gm)
title('Magnitude of gradient')
```




```
% Show result of direction
figure(5)
```

```
quiver(cosd(Gd),-sind(Gd))
title('Direction of gradient')
axis equal
axis off
axis ij
```



エッジ検出

(Edge detection)

```
% Edge detection
E = edge(I,ftype);

% Show result
figure(6)
imshow(E)
title(['Edge detection with ' ftype])
```