

Sample 8-2

離散コサイン変換

可分離変換

画像処理特論

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動作確認: MATLAB R2023a

Discrete cosine transform

Separable transforms

Advanced Topics in Image Processing

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Verified: MATLAB R2023a

準備

(Preparation)

```
close all
```

2 変量の配列定義

(Definition of bivariate array)

```
X = [ 0 2 ; 4 6 ]
```

```
X = 2x2
     0     2
     4     6
```

単変量変換行列の定義

(Definition of univariate transform)

- 回転行列(rotation matrix)

$$\mathbf{A}_\theta = \begin{pmatrix} \cos \theta & -\sin \theta \\ \sin \theta & \cos \theta \end{pmatrix}$$

- 行列 \mathbf{A}_θ による変換

$$\mathbf{y} = \mathbf{A}_\theta \mathbf{x}$$

```
Atheta = @(theta) [cos(theta) -sin(theta) ; sin(theta) cos(theta)];
theta = -pi/4;
```

```
A = Atheta(theta)
```

```
A = 2x2  
    0.7071    0.7071  
   -0.7071    0.7071
```

順変換の分離処理

(Separate process of the forward transform)

$$Y = AXA^T$$

```
fwdT = @(x) A*x*A. ';  
Y = fwdT(X)
```

```
Y = 2x2  
    6.0000    2.0000  
    4.0000    0.0000
```

逆変換の分離処理

(Separate process of the inverse transform)

$$X = A^{-1}YA^{-T}$$

```
invA = inv(A)
```

```
invA = 2x2  
    0.7071   -0.7071  
    0.7071    0.7071
```

```
invT = @(y) invA*y*invA. ';  
R = invT(Y)
```

```
R = 2x2  
   -0.0000    2.0000  
    4.0000    6.0000
```

基底展開

(Basis expansion)

```
B00 = invT([1 0; 0 0])
```

```
B00 = 2x2  
    0.5000    0.5000  
    0.5000    0.5000
```

```
B01 = invT([0 1; 0 0])
```

```
B01 = 2x2  
   -0.5000    0.5000  
   -0.5000    0.5000
```

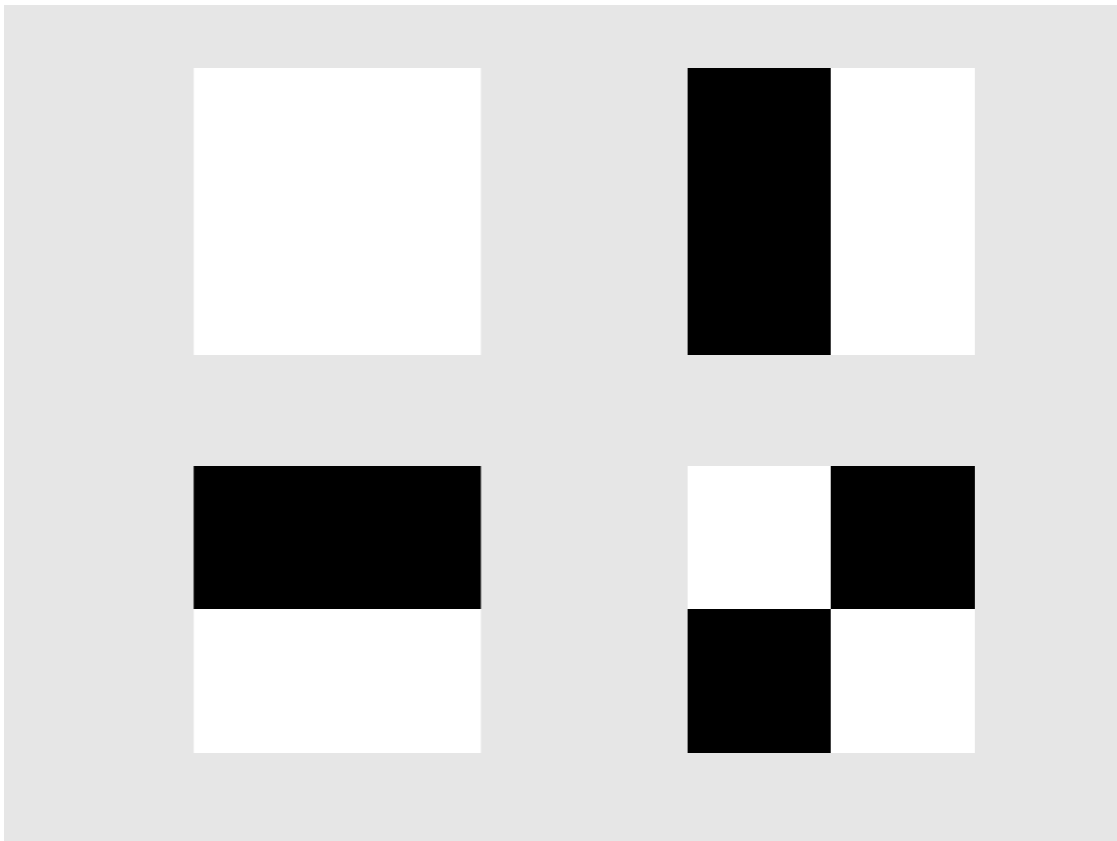
```
B10 = invT([0 0; 1 0])
```

```
B10 = 2x2
-0.5000 -0.5000
 0.5000  0.5000
```

```
B11 = invT([0 0; 0 1])
```

```
B11 = 2x2
 0.5000 -0.5000
-0.5000  0.5000
```

```
hfig1 = figure(1);
hfig1.Color = 0.9*[1 1 1];
subplot(2,2,1)
imshow(B00+.5)
subplot(2,2,2)
imshow(B01+.5)
subplot(2,2,3)
imshow(B10+.5)
subplot(2,2,4)
imshow(B11+.5)
```



```
Y(1,1)*B00 + Y(1,2)*B01 + Y(2,1)*B10 + Y(2,2)*B11
```

```
ans = 2x2
-0.0000  2.0000
```

4.0000 6.0000

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