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 R2020a

Discrete cosine transform

Separable transforms

Advanced Topics in Image Processing

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Verified: MATLAB R2020a

準備

(Preparation)

```
close all
```

2変量の配列定義

(Definition of bivariate array)

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

```
X = 2×2
     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 $\mathbf{A}_\theta$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 = 2×2
    0.7071    0.7071
   -0.7071    0.7071
```

順変換の分離処理

(Separate process of the forward transform)

$\mathbf{Y} = \mathbf{A}\mathbf{X}\mathbf{A}^T$

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

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

逆変換の分離処理

(Separate process of the inverse transform)

$\mathbf{X} = \mathbf{A}^{-1}\mathbf{Y}\mathbf{A}^{-T}$

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

```
invA = 2×2
    0.7071   -0.7071
    0.7071    0.7071
```

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

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

基底展開

(Basis expansion)

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

```
B00 = 2×2
    0.5000    0.5000
    0.5000    0.5000
```

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

```
B01 = 2×2
   -0.5000    0.5000
   -0.5000    0.5000
```

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

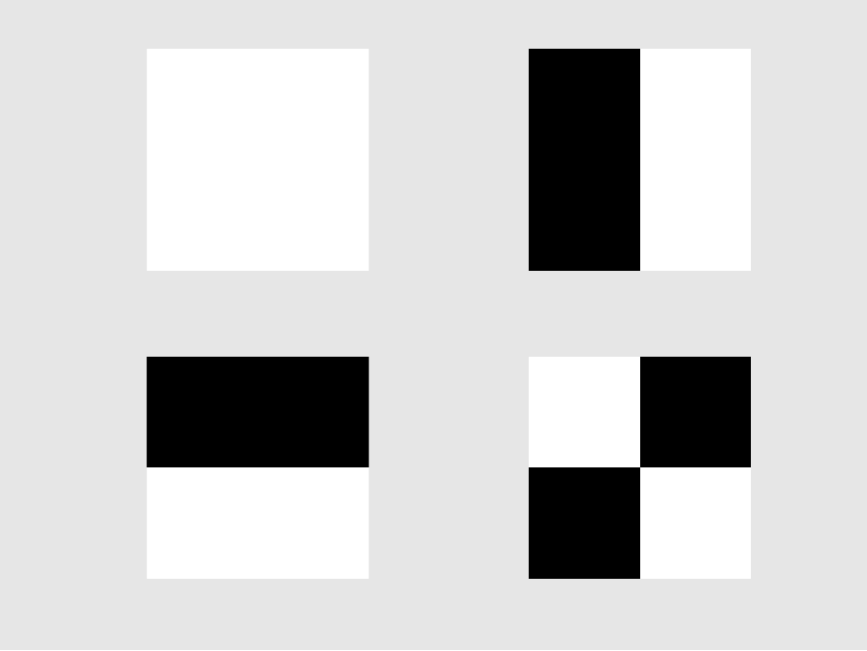
```
B10 = 2×2
```

```
   -0.5000   -0.5000
    0.5000    0.5000
```

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

```
B11 = 2×2
    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 = 2×2
   -0.0000    2.0000
    4.0000    6.0000
```