Sample 2-5

画像データの入出力

色空間変換

画像処理特論

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動作確認: MATLAB R2023a

Input and output of images

Color space conversion

Advanced Topics in Image Processing

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Verified: MATLAB R2023a

サンプル画像の準備

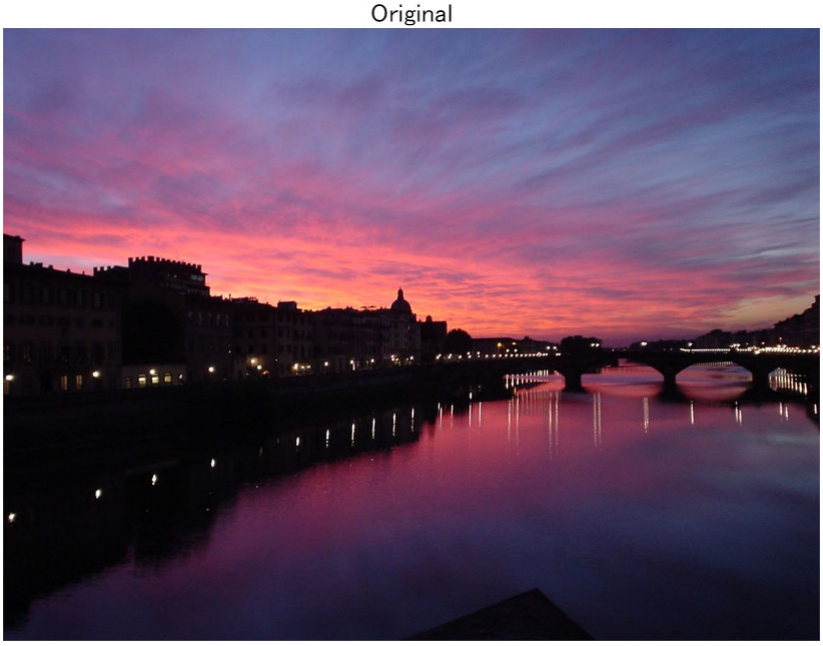
(Preparation of sample image)

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
X = im2double(imread('firenzeRgb.jpg'));
figure(1)
imshow(X)
title('Original')
```

Original



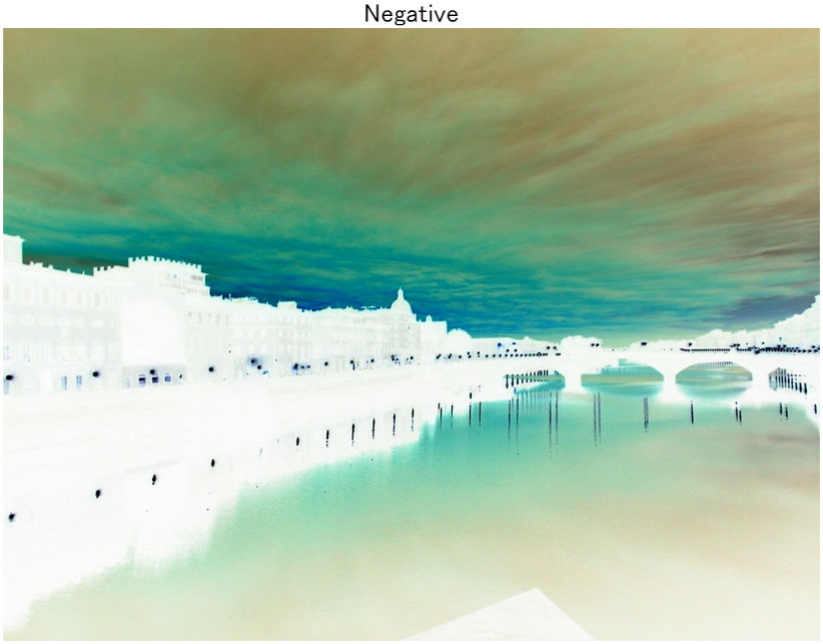
ネガ変換

(Negative conversion)

$$\begin{pmatrix} y_R \\ y_G \\ y_B \end{pmatrix} = T \begin{pmatrix} x_R \\ x_G \\ x_B \end{pmatrix} = \begin{pmatrix} 1.0 \\ 1.0 \\ 1.0 \end{pmatrix} - \begin{pmatrix} x_R \\ x_G \\ x_B \end{pmatrix}$$

```
% Definition of negative conversion
Tn = @(x) 1.0-x;
% Negative conversion of image I
Y = Tn(X);
figure(2)
imshow(Y)
title('Negative')
```

Negative



RGB 空間でべき乗則変換

(Power law conversion in RGB space)

$$\begin{pmatrix} y_{\mathrm{R}} \\ y_{\mathrm{G}} \\ y_{\mathrm{B}} \end{pmatrix} = T \begin{pmatrix} x_{\mathrm{R}} \\ x_{\mathrm{G}} \\ x_{\mathrm{B}} \end{pmatrix} = \begin{pmatrix} x_{\mathrm{R}}^{\gamma} \\ x_{\mathrm{G}}^{\gamma} \\ x_{\mathrm{B}}^{\gamma} \end{pmatrix}$$

```
% Parameter setting of power law conversion
gamma = 0.5
```

```
gamma = 0.5000
```

```
% Power law conversion in RGB space
Y = imadjust(X,[],[],gamma);
figure(3)
imshow(Y)
title('Power law conversion in RGB space')
```

Power law conversion in RGB space

HSV 空間で V 成分のみべき乗則変換

(Power law conversion for V component in HSV space)

$$\begin{pmatrix} u_{\mathrm{H}} \\ u_{\mathrm{S}} \\ u_{\mathrm{V}} \end{pmatrix} = \mathrm{rgb2hsv} \begin{pmatrix} x_{\mathrm{R}} \\ x_{\mathrm{G}} \\ x_{\mathrm{B}} \end{pmatrix}$$

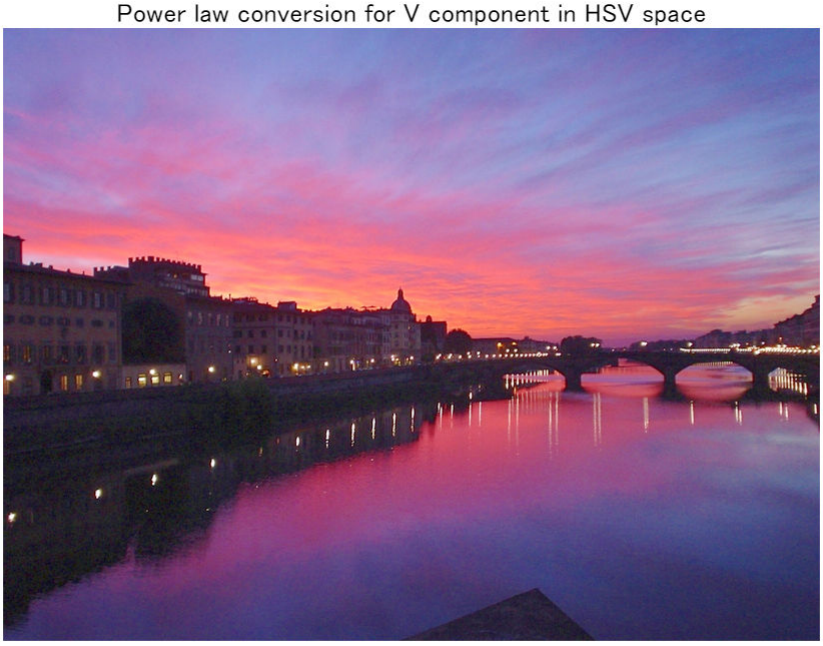
$$\begin{pmatrix} y_{\mathrm{R}} \\ y_{\mathrm{G}} \\ y_{\mathrm{B}} \end{pmatrix} = \mathrm{hsv2rgb} \begin{pmatrix} u_{\mathrm{H}} \\ u_{\mathrm{S}} \\ u_{\mathrm{V}}^{\gamma} \end{pmatrix}$$

```
% Parameter setting of power law conversion
gamma = 0.5
```

```
gamma = 0.5000
```

```
% Power law conversion for V component in HSV space
U = rgb2hsv(X);
[H,S,V] = imsplit(U);
V = imadjust(V,[],[],gamma);
U = cat(3,H,S,V);
Y = hsv2rgb(U);
figure(4)
imshow(Y)
title('Power law conversion for V component in HSV space')
```

Power law conversion for V component in HSV space



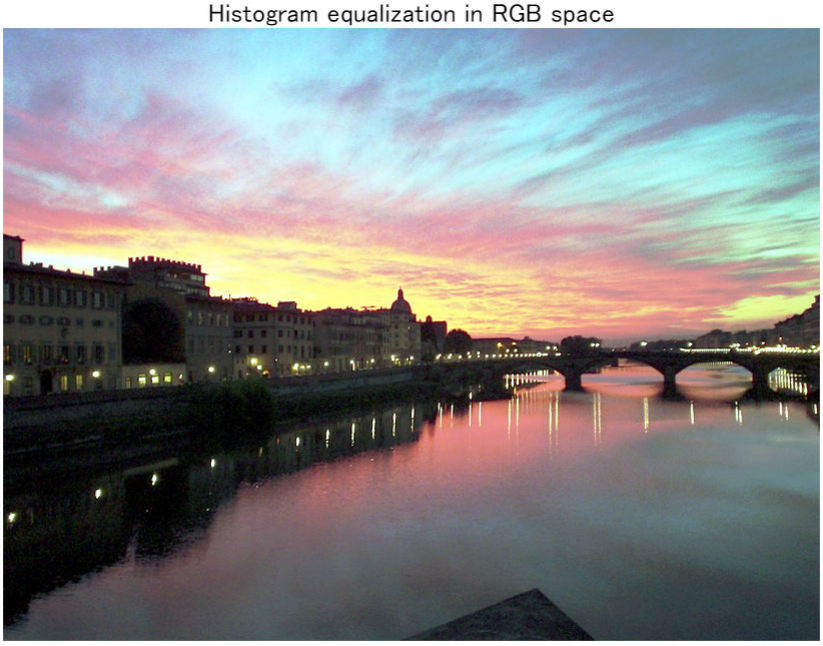
RGB 空間でヒストグラム均等化

(Histogram equalization in RGB space)

$$\begin{pmatrix} y_{\mathrm{R}} \\ y_{\mathrm{G}} \\ y_{\mathrm{B}} \end{pmatrix} = T \begin{pmatrix} x_{\mathrm{R}} \\ x_{\mathrm{G}} \\ x_{\mathrm{B}} \end{pmatrix} = \begin{pmatrix} \mathrm{histeq}(x_{\mathrm{R}}) \\ \mathrm{histeq}(x_{\mathrm{G}}) \\ \mathrm{histeq}(x_{\mathrm{B}}) \end{pmatrix}$$

```
% Histogram equalization in RGB space
[R,G,B] = imsplit(X);
R = histeq(R);
G = histeq(G);
B = histeq(B);
Y = cat(3,R,G,B);
figure(5)
imshow(Y)
title('Histogram equalization in RGB space')
```

Histogram equalization in RGB space



HSV 空間で V 成分のみヒストグラム均等化

(Histogram equalization for V component in HSV space)

$$\begin{pmatrix} u_{\mathrm{H}} \\ u_{\mathrm{S}} \\ u_{\mathrm{V}} \end{pmatrix} = \mathrm{rgb2hsv} \begin{pmatrix} x_{\mathrm{R}} \\ x_{\mathrm{G}} \\ x_{\mathrm{B}} \end{pmatrix}$$

$$\begin{pmatrix} y_{\mathrm{R}} \\ y_{\mathrm{G}} \\ y_{\mathrm{B}} \end{pmatrix} = \mathrm{hsv2rgb} \begin{pmatrix} u_{\mathrm{H}} \\ u_{\mathrm{S}} \\ \mathrm{histeq}(u_{\mathrm{V}}) \end{pmatrix}$$

```
% Histogram equalization for V component in HSV space
U = rgb2hsv(X);
[H,S,V] = imsplit(U);
V = histeq(V);
U = cat(3,H,S,V);
Y = hsv2rgb(U);
figure(6)
imshow(Y)
title('Histogram equalization for V component in HSI space')
```

Histogram equalization for V component in HSI space