

Cvičení 2

RGB to GRAY

```
I_rgb = imread('pastelky2.jpg');  
figure, subplot(1,3,1), imshow(I_rgb);
```

prumerovanim slozek

```
gray1 = (1/3)*I_rgb(:,:,1) + (1/3)*I_rgb(:,:,2) + (1/3)*I_rgb(:,:,3);  
subplot(1,3,2), imshow(gray1,[]);
```

vazeny prumer

```
gray2 = rgb2gray(I_rgb);  
subplot(1,3,3), imshow(gray2,[]);
```



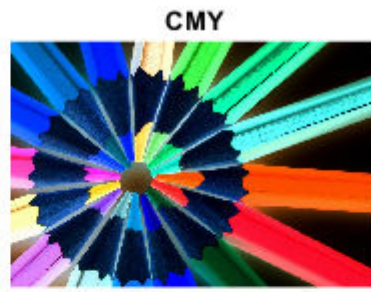
RGB to CMY

```
I_cmy = rgb2cmy(I_rgb);  
%I = 255 - I2;  
I_rgb2 = cmy2rgb(I_cmy);  
  
figure, subplot(2,2,1), imshow(I_rgb);  
title('RGB');  
subplot(2,2,2), imshow(I_cmy);
```

```

title('CMY');
subplot(2,2,3), imshow(I_rgb2);
title('RGB');

```



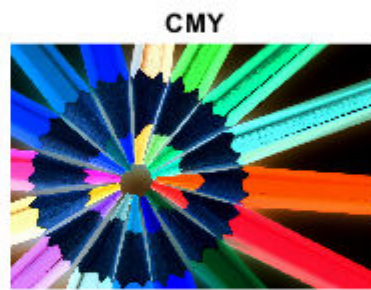
CMY to RGB

```

I_rgb = imcomplement(I_cmy);
%I = 255 - I2;

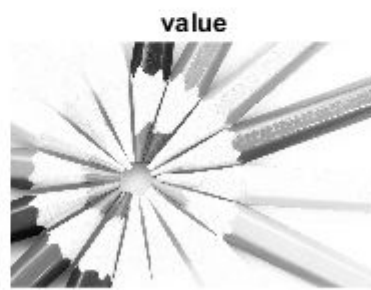
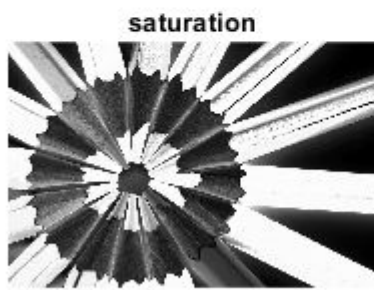
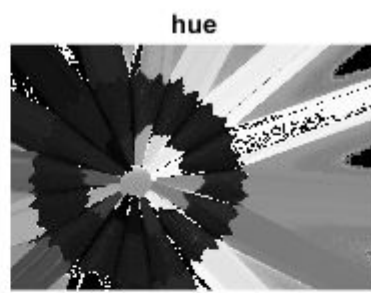
figure, subplot(1,2,1), imshow(I_rgb);
title('RGB');
subplot(1,2,2), imshow(I_cmy);
title('CMY');

```



RGB to HSV

```
I_hsv = rgb2hsv(I_rgb);  
  
figure, subplot(2,2,1), imshow(I_rgb);  
title('RGB');  
subplot(2,2,2), imshow(I_hsv(:,:,1));  
title('hue');  
subplot(2,2,3), imshow(I_hsv(:,:,2));  
title('saturation');  
subplot(2,2,4), imshow(I_hsv(:,:,3));  
title('value');
```



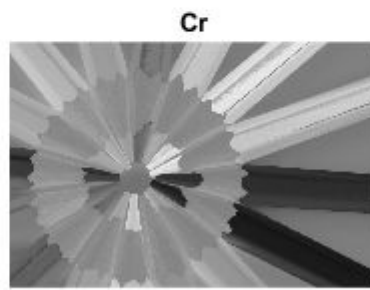
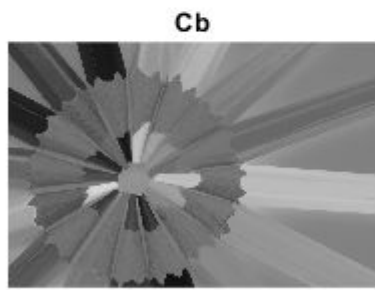
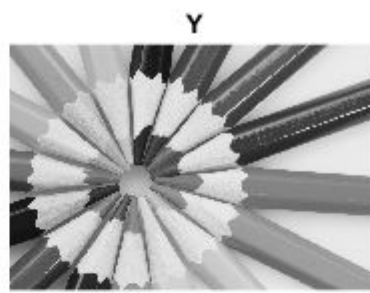
HSV to RGB

```
I_rgb2 = hsv2rgb(I_hsv);  
figure, imshow(I_rgb2);
```



RGB to YCbCr

```
I_ycbcr = rgb2ycbcr(I_rgb);  
  
figure, subplot(2,2,1), imshow(I_rgb);  
title('RGB');  
subplot(2,2,2), imshow(I_ycbcr(:,:,1));  
title('Y');  
subplot(2,2,3), imshow(I_ycbcr(:,:,2));  
title('Cb');  
subplot(2,2,4), imshow(I_ycbcr(:,:,3));  
title('Cr');
```



YCbCr to RGB

```
I_rgb2 = ycbcr2rgb(I_ycbcr);  
figure, imshow(I_rgb2);
```




Rozliseni

skutecna velikost obrazu pri tisku

```
B = imread('pastelky2.jpg');  
  
imwrite(B, 'p1.tif','resolution',[1000,1000]);  
imfinfo('p1.tif')
```

ans = struct with fields:

```
    Filename: 'C:\Skola\vyuka2021-2022\ZS\PG\cvičení\cviceni2\p1.tif'  
   FileModDate: '05-říj-2021 08:50:11'  
    FileSize: 3899232  
     Format: 'tif'  
FormatVersion: []  
      Width: 1400  
     Height: 933  
   BitDepth: 24  
   ColorType: 'truecolor'  
FormatSignature: [73 73 42 0]  
   ByteOrder: 'little-endian'  
NewSubFileType: 0  
 BitsPerSample: [8 8 8]  
   Compression: 'PackBits'  
PhotometricInterpretation: 'RGB'
```

```

        StripOffsets: [1×67 double]
        SamplesPerPixel: 3
        RowsPerStrip: 14
        StripByteCounts: [1×67 double]
        XResolution: 1000
        YResolution: 1000
        ResolutionUnit: 'Inch'
        Colormap: []
        PlanarConfiguration: 'Chunky'
        TileWidth: []
        TileLength: []
        TileOffsets: []
        TileByteCounts: []
        Orientation: 1
        FillOrder: 1
        GrayResponseUnit: 0.0100
        MaxSampleValue: [255 255 255]
        MinSampleValue: [0 0 0]
        Thresholding: 1
        Offset: 3898500

```

```

imwrite(B, 'p2.tif','resolution',[500,500]);
imfinfo('p2.tif')

```

ans = struct with fields:

```

        Filename: 'C:\Skola\vyuka2021-2022\ZS\PG\cvičení\cviceni2\p2.tif'
        FileModDate: '05-řij-2021 08:50:11'
        FileSize: 3899232
        Format: 'tif'
        FormatVersion: []
        Width: 1400
        Height: 933
        BitDepth: 24
        ColorType: 'truecolor'
        FormatSignature: [73 73 42 0]
        ByteOrder: 'little-endian'
        NewSubFileType: 0
        BitsPerSample: [8 8 8]
        Compression: 'PackBits'
        PhotometricInterpretation: 'RGB'
        StripOffsets: [1×67 double]
        SamplesPerPixel: 3
        RowsPerStrip: 14
        StripByteCounts: [1×67 double]
        XResolution: 500
        YResolution: 500
        ResolutionUnit: 'Inch'
        Colormap: []
        PlanarConfiguration: 'Chunky'
        TileWidth: []
        TileLength: []
        TileOffsets: []
        TileByteCounts: []
        Orientation: 1
        FillOrder: 1
        GrayResponseUnit: 0.0100
        MaxSampleValue: [255 255 255]
        MinSampleValue: [0 0 0]
        Thresholding: 1
        Offset: 3898500

```

```

imwrite(B, 'p3.tif','resolution',[250,250]);
imfinfo('p3.tif')

```



```
ans = struct with fields:
    Filename: 'C:\Skola\vyuka2021-2022\ZS\PG\cvičení\cviceni2\p3.tif'
    FileModDate: '05-říj-2021 08:50:11'
    FileSize: 3899232
    Format: 'tif'
    FormatVersion: []
    Width: 1400
    Height: 933
    BitDepth: 24
    ColorType: 'truecolor'
    FormatSignature: [73 73 42 0]
    ByteOrder: 'little-endian'
    NewSubFileType: 0
    BitsPerSample: [8 8 8]
    Compression: 'PackBits'
    PhotometricInterpretation: 'RGB'
    StripOffsets: [1×67 double]
    SamplesPerPixel: 3
    RowsPerStrip: 14
    StripByteCounts: [1×67 double]
    XResolution: 250
    YResolution: 250
    ResolutionUnit: 'Inch'
    Colormap: []
    PlanarConfiguration: 'Chunky'
    TileWidth: []
    TileLength: []
    TileOffsets: []
    TileByteCounts: []
    Orientation: 1
    FillOrder: 1
    GrayResponseUnit: 0.0100
    MaxSampleValue: [255 255 255]
    MinSampleValue: [0 0 0]
    Thresholding: 1
    Offset: 3898500
```

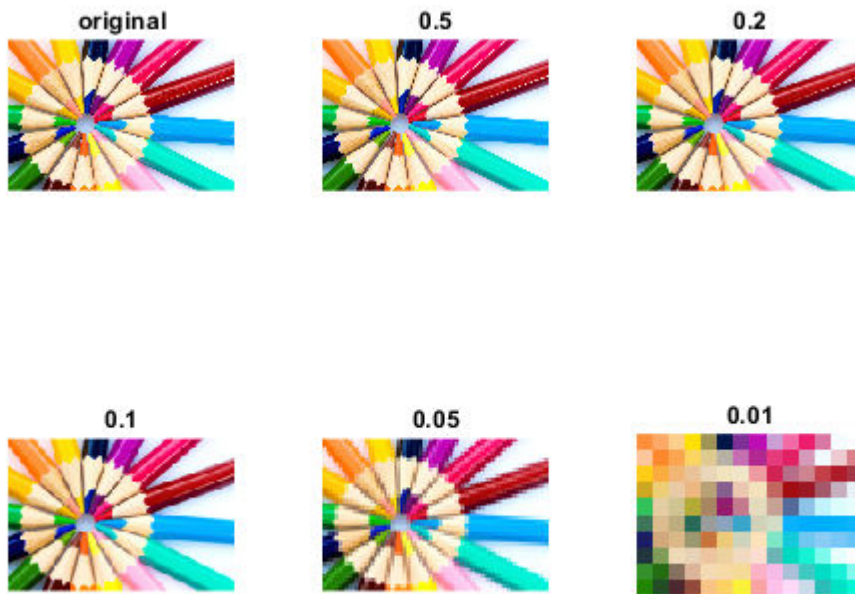
Rozliseni

velikost obrazu

```
B1 = imresize(B,0.5);
B2 = imresize(B,0.2);
B3 = imresize(B,0.1);
B4 = imresize(B,0.05);
B5 = imresize(B,0.01);

figure, subplot(2,3,1), imshow(B);
title('original');
subplot(2,3,2), imshow(B1);
title('0.5');
subplot(2,3,3), imshow(B2);
title('0.2');
subplot(2,3,4), imshow(B3);
title('0.1');
subplot(2,3,5), imshow(B4);
title('0.05');
```

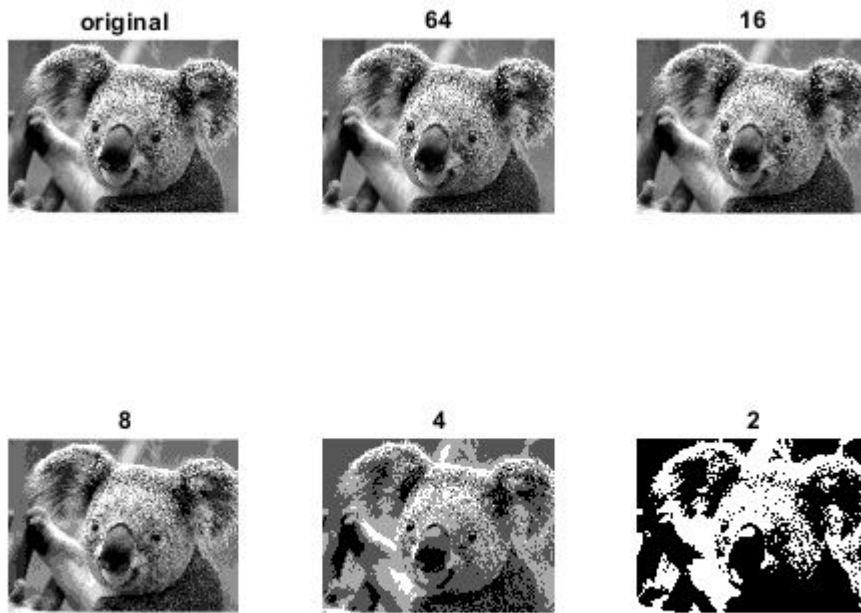
```
subplot(2,3,6), imshow(B5);
title('0.01');
```



Barevná hloubka

```
B = imread('picture1.png');
Bi = gray2ind(B,256);
Bi1 = gray2ind(B,64);
Bi2 = gray2ind(B,16);
Bi3 = gray2ind(B,8);
Bi4 = gray2ind(B,4);
Bi5 = gray2ind(B,2);

figure, subplot(2,3,1), imshow(Bi,[]);
title('original');
subplot(2,3,2), imshow(Bi1,[]);
title('64');
subplot(2,3,3), imshow(Bi2,[]);
title('16');
subplot(2,3,4), imshow(Bi3,[]);
title('8');
subplot(2,3,5), imshow(Bi4,[]);
title('4');
subplot(2,3,6), imshow(Bi5,[]);
title('2')
```



Interpolace

Nejblizsi soused

(Nearest neighbor)

```
I = [1 0 1 0 1];
J_near = imresize(I,1.5,'nearest');

figure, imshow(J_near);
```

..

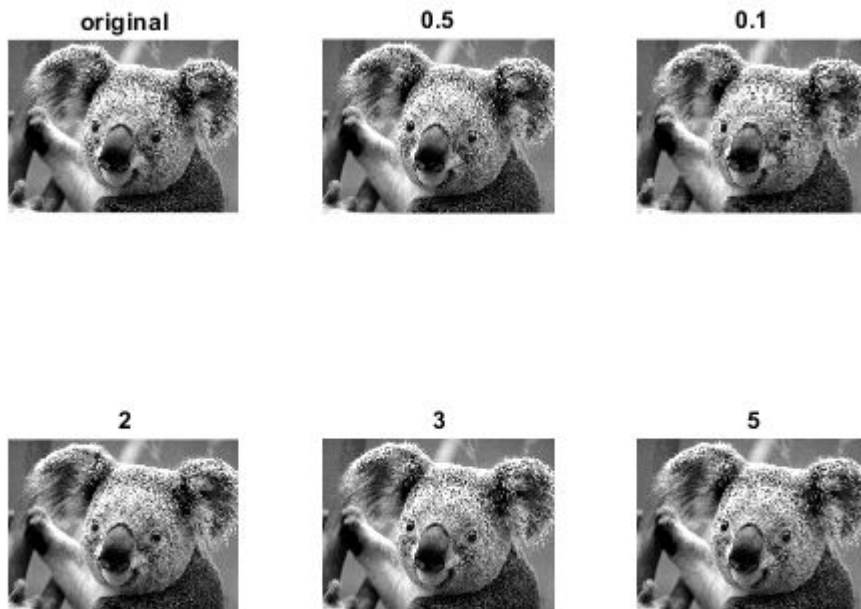
```
B = imread('picture1.png');
B1a = imresize(B,0.5, 'nearest');
B2a = imresize(B,0.1, 'nearest');
```

```

B3a = imresize(B,2, 'nearest');
B4a = imresize(B,3, 'nearest');
B5a = imresize(B,5, 'nearest');

figure, subplot(2,3,1), imshow(B);
title('original');
subplot(2,3,2), imshow(B1a);
title('0.5');
subplot(2,3,3), imshow(B2a);
title('0.1');
subplot(2,3,4), imshow(B3a);
title('2');
subplot(2,3,5), imshow(B4a);
title('3');
subplot(2,3,6), imshow(B5a);
title('5');

```



Bilinear

```

I = [1 0 1 0 1];
J_bilin = imresize(I,1.5,'bilinear');

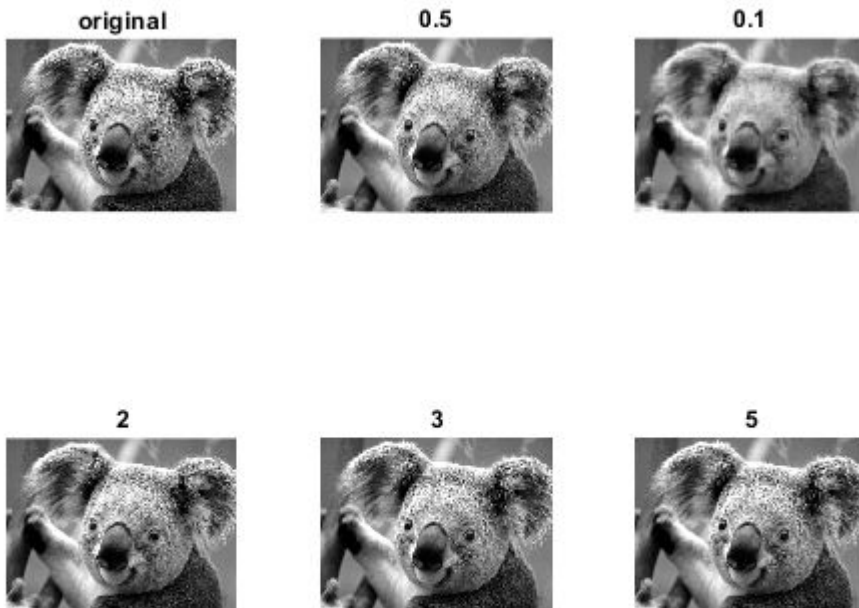
figure, imshow(J_bilin);

```

..

```
B1b = imresize(B,0.5, 'bilinear');
B2b = imresize(B,0.1, 'bilinear');
B3b = imresize(B,2, 'bilinear');
B4b = imresize(B,3, 'bilinear');
B5b = imresize(B,4, 'bilinear');

figure, subplot(2,3,1), imshow(B);
title('original');
subplot(2,3,2), imshow(B1b);
title('0.5');
subplot(2,3,3), imshow(B2b);
title('0.1');
subplot(2,3,4), imshow(B3b);
title('2');
subplot(2,3,5), imshow(B4b);
title('3');
subplot(2,3,6), imshow(B5b);
title('5');
```

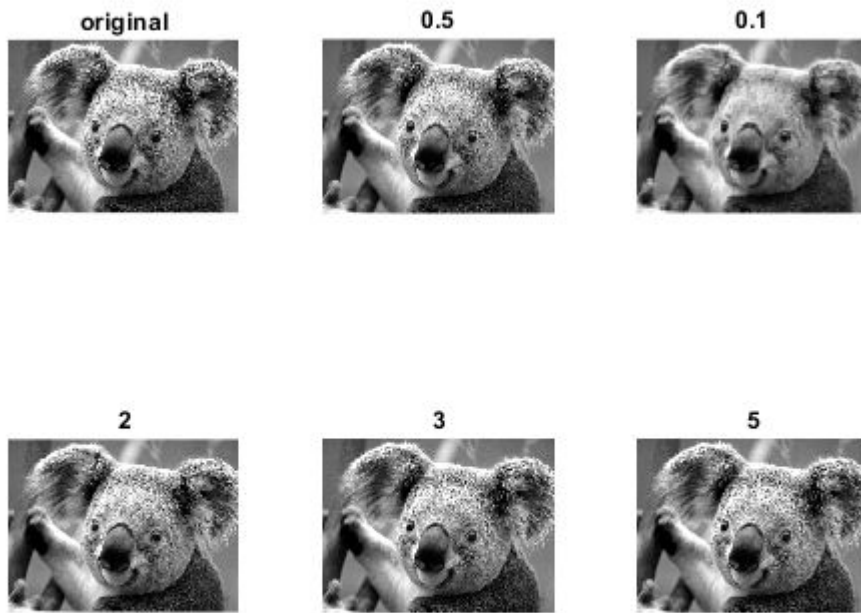


Bikubicka

```
I = [1 0 1 0 1];  
J_bicub = imresize(I,1.5,'bicubic');  
  
figure, imshow(J_bicub);
```

..

```
B1c = imresize(B,0.5, 'bicubic');  
B2c = imresize(B,0.1, 'bicubic');  
B3c = imresize(B,2, 'bicubic');  
B4c = imresize(B,3, 'bicubic');  
B5c = imresize(B,5, 'bicubic');  
  
figure, subplot(2,3,1), imshow(B);  
title('original');  
subplot(2,3,2), imshow(B1c);  
title('0.5');  
subplot(2,3,3), imshow(B2c);  
title('0.1');  
subplot(2,3,4), imshow(B3c);  
title('2');  
subplot(2,3,5), imshow(B4c);  
title('3');  
subplot(2,3,6), imshow(B5c);  
title('5');
```



```
figure,
subplot(1,3,1), imshow(J_near);
title('nejblizsi soused');
subplot(1,3,2), imshow(J_bilin);
title('bilinearni');
subplot(1,3,3), imshow(J_bicub);
title('bikubicka');
```

nejblizsi soused



bilinearni



bikubicka



Snizeni barevne hloubky

Nahodne rozptylovani

zpracovani prvek po prvku

```
I = imread('skala.png');  
  
Cmax = max(max(I));  
  
J = uint8(zeros(size(I,1),size(I,2)));  
  
for i = 1 : size(I,1)  
    for j = 1 : size(I,2)  
        % randi vrati nahodne cislo  
        r = randi(Cmax);  
        if I(i,j) > r  
            J(i,j) = J(i,j) + 1;  
        end  
    end  
end  
  
figure  
subplot(1,2,1)  
imshow(I,[])  
subplot(1,2,2)  
imshow(J,[]);
```



zpracovani pomoci maticovych operaci

```
I = imread('skala.png');  
[m,n] = size(I);  
Cmax = max(max(I));  
J = uint8(zeros(size(I,1),size(I,2)));  
  
J = J + uint8(I >= randi(Cmax,[m,n]));  
figure  
subplot(1,2,1)  
imshow(I,[]);  
subplot(1,2,2)  
imshow(J,[]);
```



Spatny pristup

porovnavaji se vsechny pixely se stejnou hodnotou.

```
I = imread('skala.png');
[m,n] = size(I);
Cmax = max(max(I));
J = uint8(zeros(size(I,1),size(I,2)));

J = (I >= randi(Cmax));

figure
subplot(1,2,1)
imshow(I,[]);
subplot(1,2,2)
imshow(J,[]);
```



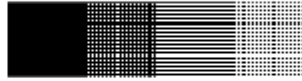

Maticove rozptylovani

Zvetseni velikosti obrazu

```
I2 = imread('skala.png');  
[ J ] = matrix_dithering( I2 );
```

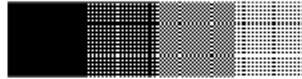
```
patern = 2x2  
    204    153  
    102     51
```

```
figure  
subplot(1,2,1)  
imshow(I2,[]);  
subplot(1,2,2)  
imshow(J,[]);
```



Nevhodne zvolene matice

```
I2 = imread('skala.png');  
[ J ] = matrix_dithering2( I2 );  
  
figure  
subplot(1,2,1)  
imshow(I2,[]);  
subplot(1,2,2)  
imshow(J,[]);
```

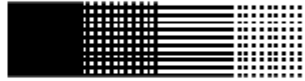


Maticove rozptylovani se zachovanim velikosti

```
I2 = imread('skala.png');  
[ J ] = matrix_dithering3( I2 );
```

```
patern = 2×2  
    204    153  
    102     51
```

```
figure  
subplot(1,2,1)  
imshow(I2,[]);  
subplot(1,2,2)  
imshow(J,[]);
```



Ukol 1

Upravte funkci `matrix_dithering3` tak, aby k rozptylovani pouzila matici 4x4. Vyzkousejte ruzne matice. Odevzdejte kod (prpadne kody) a alespon 2 obrazky, které vznikly maticovym rozptylovanim s ruznymi maticema.

Rozptylovani s distribuci chyby

Floyd Steinberg

```
I2 = imread('skala.png');  
J = floyd_steinberg( I2 );  
  
figure  
subplot(1,2,1)  
imshow(I2,[]);  
subplot(1,2,2)  
imshow(J,[]);
```



Ukol 2

Napiste skript na barevne nahodne rozptylovani, maticove rozptylovani a rozptylovani s distribuci chyby.

Napoveda:

Kazda barevna slozka se zpracovava zvlast.

```
I_red = I(:, :, 1);  
I_green = I(:, :, 2);
```

Index in position 3 exceeds array bounds (must not exceed 1).

```
I_blue = I(:, :, 3);  
  
% zde ma byt kod pro zpracovani jednotlivych slozek  
  
J(:, :, 1) = J_red;  
J(:, :, 2) = J_green;  
J(:, :, 3) = J_blue;
```

Odevzdejte skript a vysledne obrazky pri aplikaci na nejaky barevny obrazek.