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Report accepted: _____

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LABORATORY REPORT #1

Image Types and Image Coding

on subject 'Image Processing'

Variant 10

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THE PURPOSE of the laboratory work is to get knowledge about types of images, its processing and representation in MATLAB.

NECESSARY DATA: Images - *pears.png*, *rice.png*, *spine.tif*;
Image Processing Toolbox (built-in).

DESCRIPTION OF WORK PROGRESS:

Defining the array of strings containing names of required images:

```
imArray = {'pears.png', 'rice.png', 'spine.tif'}
```

Let's iterate through the each image to get information about it's color type, logical description, resolution and other applied attributes:

```
for i = 1:length(imArray)
    im = imArray{i};
    picture = imread(im);
    info = imfinfo(im);
    figure(i), imshow(picture);

    % checking for gray or rgb or indexed
    if isequal(info.ColorType, 'truecolor')
        isgray = false;
        isrgb = true;
        isind = false;
    elseif isequal(info.ColorType, 'grayscale')
        isgray = true;
        isrgb = false;
        isind = false;
    else isequal(info.ColorType, 'indexed')
        isgray = false;
        isrgb = false;
        isind = true;
    end
```

Due to absence of isgray(), isrgb() and isind() functions in new versions of MATLAB, we can extract same data from imfinfo() function that returns 'struct'-typed variable. Moreover, it is possible to combine several attributes of imfinfo() output if necessary.
In the above part of the code, I have also plotted these images and saved them into figures.

Get the output of the image using f-string and put it into our loop:

```
    txt1 = 'Params of image %d: \n isLogical: %d \n isGray: %d \n
    isRGB: %d \n isIndexed: %d';
    logic = islogical(picture);
    str = sprintf(txt1, i, logic, isgray, isrgb, isind);
    disp(str);
    txt2 = ' Image Info:';
```

```
    disp(txt2);
    disp(info);
```

Example of the Output:

```
Params of image 1:
 isLogical: 0
 isGray: 0
 isRGB: 1
 isIndexed: 0
 Image Info:
                  Filename:                                    'C:\Program
Files\MATLAB\R2021b\toolbox\images\imdata\pears.png'
               FileModDate: '03-May-2003 21:53:57'
                  FileSize: 554554
                    Format: 'png'
             FormatVersion: []
                     Width: 732
                    Height: 486
                  BitDepth: 24
                 ColorType: 'truecolor'
           FormatSignature: [137 80 78 71 13 10 26 10]
                  Colormap: []
                 Histogram: []
              InterlaceType: 'none'
               Transparency: 'none'
    SimpleTransparencyData: []
           BackgroundColor: []
```

```
RenderingIntent: []
 Chromaticities: []
          Gamma: []
    XResolution: []
    YResolution: []
 ResolutionUnit: []
        XOffset: []
        YOffset: []
     OffsetUnit: []
SignificantBits: []
   ImageModTime: '20 Feb 2003 20:53:33 +0000'
          Title: []
         Author: []
    Description: []
      Copyright: 'Copyright Corel'
   CreationTime: []
       Software: []
     Disclaimer: []
        Warning: []
         Source: []
        Comment: []
      OtherText: []
```

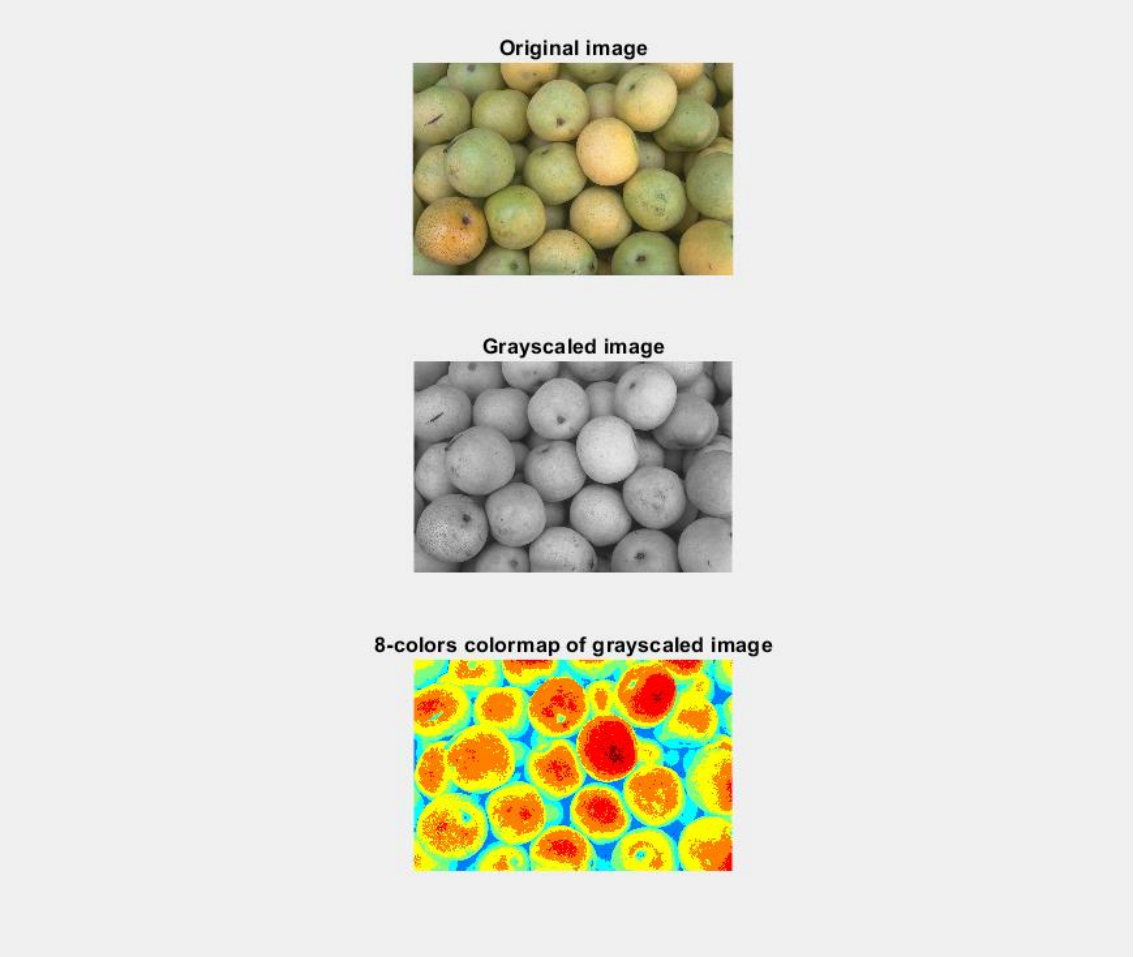
Secondly, let's do some image conversing. I have made to examples with RGB to Gray-scaled improved by jet-colormap and RGB to Black & White.

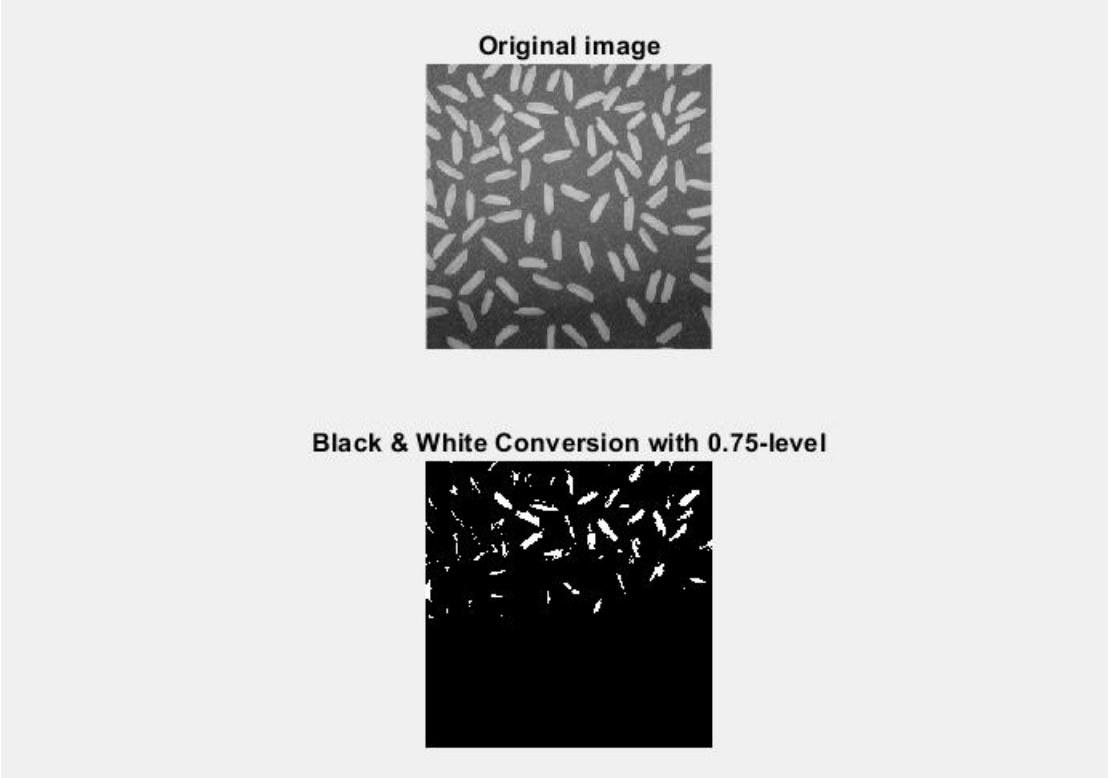
Code of the conversing process:

```
% RGB to Grayscaled with Sliced colors and jet-colormap
X = imread(imArray{1});
X_gray = rgb2gray(X);
X_ind = grayslice(X_gray, 8);
figure(4),
subplot(311), imshow(X); title('Original image'); hold on;
subplot(312), imshow(X_gray); title('Grayscaled image'); hold on;
subplot(313), imshow(X_ind, jet(8)); title('8-colors colormap of
grayscaled image'); hold on;

% RGB to B&W
Y = imread(imArray{2});
Y_bw = im2bw(Y, 0.75);
figure(5),
subplot(211), imshow(Y); title('Original image'); hold on;
subplot(212), imshow(Y_bw); title('Black & White Conversion with
0.75-level'); hold on;
```

That’s what we have in the output:



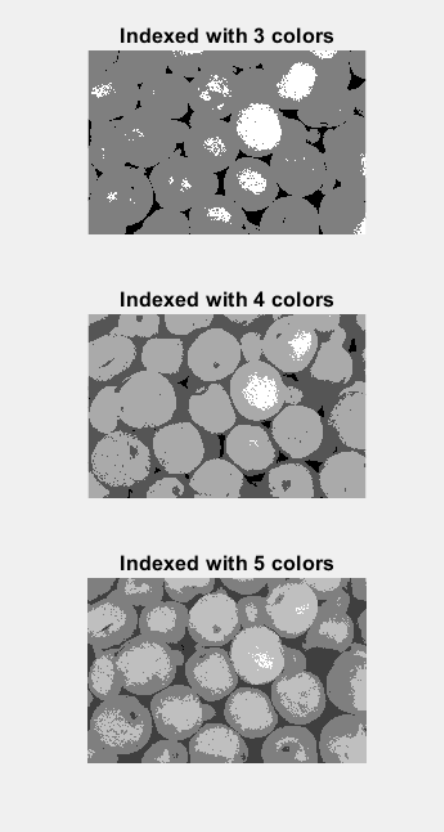


At the request of the teacher, colormaps of different levels were built for a black and white image:

```
[X_out1, map1] = gray2ind(X_gray, 3);
[X_out2, map2] = gray2ind(X_gray, 4);
[X_out3, map3] = gray2ind(X_gray, 5);

figure(6),
subplot(311), imshow(X_out1, map1); title('Indexed with 3 colors');
hold on;
subplot(312), imshow(X_out2, map2); title('Indexed with 4 colors');
hold on;
subplot(313), imshow(X_out3, map3); title('Indexed with 5 colors');
hold on;
```

Therefore, the output:



CONCLUSIONS

There were described and processed three built-in images in MATLAB according to description process, conversion and colormap levels iteration. As a result, we have got information about main parameters of the each image, its types, transformation approaches and edition possibilities.

FULL PROGRAM CODE:

```
clear;
close all hidden;

% Making array of image names
imArray = {'pears.png', 'rice.png', 'spine.tif'};

% Iterating through the each image to get main information about it
for i = 1:length(imArray)
    im = imArray{i};
    picture = imread(im);
    info = imfinfo(im);
    figure(i), imshow(picture);

    % checking for gray or rgb or indexed
    if isequal(info.ColorType, 'truecolor')
        isgray = false;
        isrgb = true;
        isind = false;
    elseif isequal(info.ColorType, 'grayscale')
        isgray = true;
        isrgb = false;
        isind = false;
    else isequal(info.ColorType, 'indexed')
        isgray = false;
        isrgb = false;
        isind = true;
    end


    % preparing string output using f-string
    txt1 = 'Params of image %d: \n isLogical: %d \n isGray: %d \n
isRGB: %d \n isIndexed: %d';
    logic = islogical(picture);
    str = sprintf(txt1, i, logic, isgray, isrgb, isind);
    disp(str);
    txt2 = ' Image Info:';
    disp(txt2);
    disp(info);
end

% Examples of conversing images

    % RGB to Grayscaled with Sliced colors and jet-colormap
X = imread(imArray{1});
X_gray = rgb2gray(X);
X_ind = grayslice(X_gray, 8);
figure(4),
subplot(311), imshow(X); title('Original image'); hold on;
subplot(312), imshow(X_gray); title('Grayscaled image'); hold on;
subplot(313), imshow(X_ind, jet(8)); title('8-colors colormap of
grayscaled image'); hold on;
```

```
    % RGB to B&W
Y = imread(imArray{2});
Y_bw = im2bw(Y, 0.75);
figure(5),
subplot(211), imshow(Y); title('Original image'); hold on;
subplot(212), imshow(Y_bw); title('Black & White Conversion with
0.75-level'); hold on;


% Working with colormaps

[X_out1, map1] = gray2ind(X_gray, 3);
[X_out2, map2] = gray2ind(X_gray, 4);
[X_out3, map3] = gray2ind(X_gray, 5);

figure(6),
subplot(311), imshow(X_out1, map1); title('Indexed with 3 colors');
hold on;
subplot(312), imshow(X_out2, map2); title('Indexed with 4 colors');
hold on;
subplot(313), imshow(X_out3, map3); title('Indexed with 5 colors');
hold on;
```