HOMEWORK 6a

SOLUTIONS

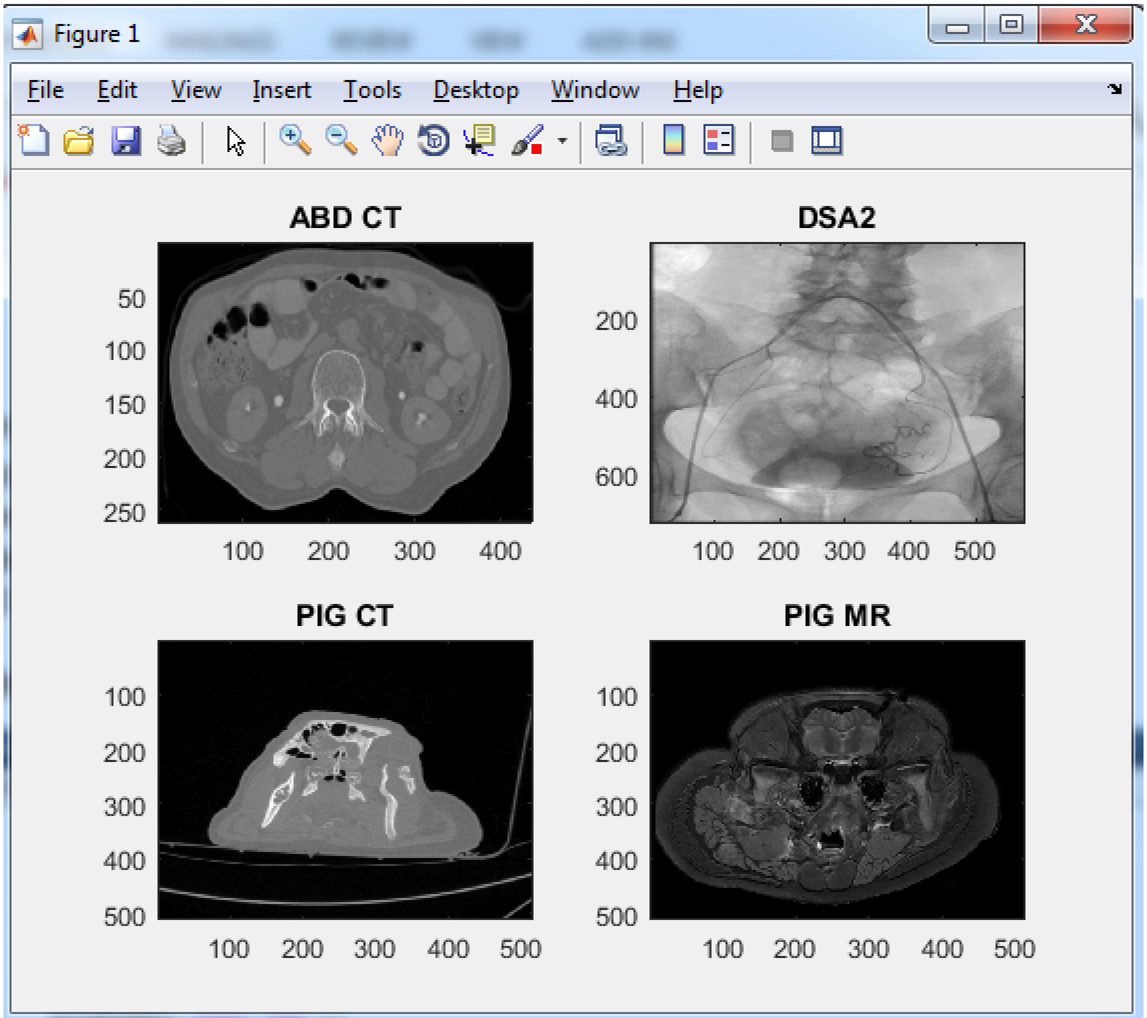
1. Plot four images on a single page, using the 'subplot' command. You can choose 4 different images given in the "Data_for_images" folder. One of the 4 images has to be loaded with a Dicom format. There are two dicom-formatted data files: PIG_MR and PIG_CT. Please recognize if these two data sets are 2-D or 3D data files.

Solution

Editor - C:\Users\dell\Documents\Masters\Fall 15-1st sem\Matlab Programs\HW_6a_oct_15\que_1.m

prac4.m | prac2.m | que_1.m

```matlab
clc
clear all
close all
a=imread('ABD_CT.jpg');
subplot(2,2,1)
imagesc(a),title('ABD CT')
b=imread('DSA2.jpg');
subplot(2,2,2)
imagesc(b),title('DSA2')
c=double(dicomread('PIG_CT'));
subplot(2,2,3)
imagesc(c),title('PIG CT')
d=double(dicomread('PIG_MR'));
subplot(2,2,4)
imagesc(d),colormap(gray),title('PIG MR')
```



2. Calculate signal to noise ratios for the 8 CT images given in the SNR subfolder that you can download from the following website: http://www.crcpress.com/product/isbn/9781466555570

   Please write a flow chart and then show your script as well as the results. Please explain where you choose your signal-free regions.

   Note: You do not have to use a '`for`' loop, but you can if you wish. Please use your own coding, not copying from the book.

Solution

Flow chart

1. Read the image file 'chicken.dcm' using 'dicomread'
2. Plot the image
3. Set the background variable

4. Find the standard deviation of chosen background and mean of the original image.
5. Calculate SNR by using following equation.

$$SNR=\rho_{\text{average over image}}/\sigma(\rho_{\text{bg}})$$

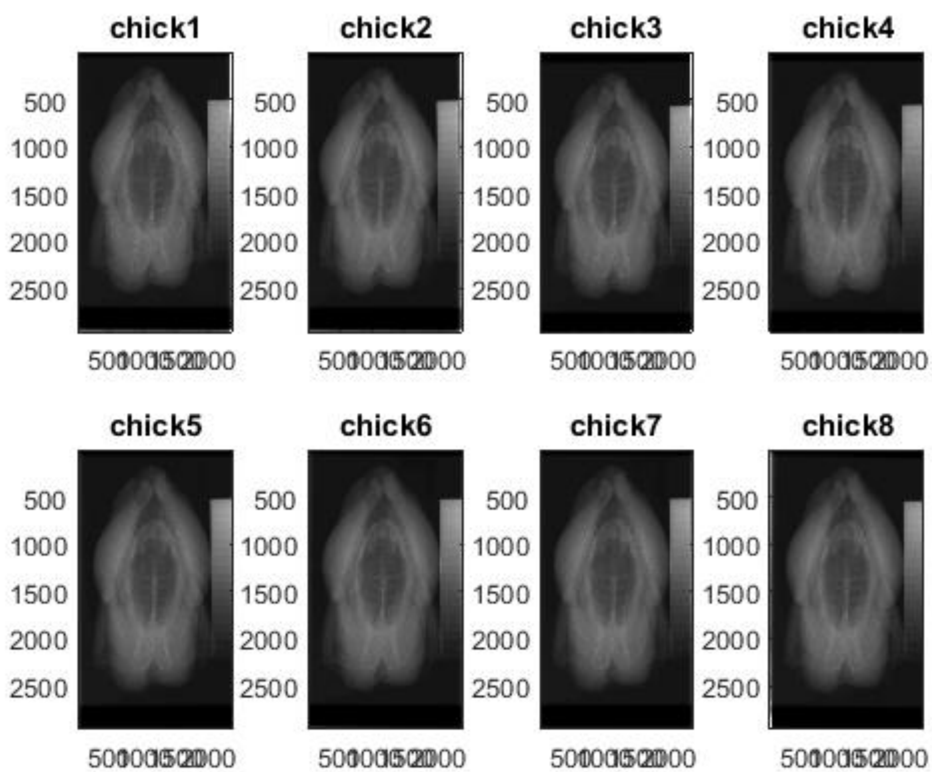
6. Repeat the above steps for 8 CT images.

```
clc

clear all
close all
%SNR for chick1
chick1=double(dicomread('chicken1.dcm'));
subplot(2,4,1)
imagesc(chick1),colormap(gray),title('chick1')
chick1_bg=chick1(1:200,1:250);
chick1_std=std2(chick1_bg);
chick1_avg=mean2(chick1);
chick1_snr=chick1_avg/chick1_std

%SNR for chick2
chick2=double(dicomread('chicken2.dcm'));
subplot(2,4,2)
imagesc(chick2),colormap(gray),title('chick2')
chick2_bg=chick2(1:200,1:250);
chick2_std=std2(chick2_bg);
chick2_avg=mean2(chick2);
chick2_snr=chick2_avg/chick2_std

%SNR for chick3
chick3=double(dicomread('chicken3.dcm'));
subplot(2,4,3)
imagesc(chick3),colormap(gray),title('chick3')
chick3_bg=chick3(1:200,1:250);
chick3_std=std2(chick3_bg);
chick3_avg=mean2(chick3);
chick3_snr=chick3_avg/chick3_std

%SNR for chick4
chick4=double(dicomread('chicken4.dcm'));
subplot(2,4,4)
imagesc(chick4),colormap(gray),title('chick4')
chick4_bg=chick4(1:200,1:250);
chick4_std=std2(chick4_bg);
chick4_avg=mean2(chick4);
chick4_snr=chick4_avg/chick4_std

%SNR for chick5
chick5=double(dicomread('chicken5.dcm'));
```

```
subplot(2,4,5)
imagesc(chick5),colormap(gray),title('chick5')
chick5_bg=chick5(1:200,1:250);
chick5_std=std2(chick5_bg);
chick5_avg=mean2(chick5);
chick5_snr=chick5_avg/chick5_std

%SNR for chick6
chick6=double(dicomread('chicken6.dcm'));
subplot(2,4,6)
imagesc(chick6),colormap(gray),title('chick6')
chick6_bg=chick6(1:200,1:250);
chick6_std=std2(chick6_bg);
chick6_avg=mean2(chick6);
chick6_snr=chick6_avg/chick6_std

%SNR for chick7
chick7=double(dicomread('chicken7.dcm'));
subplot(2,4,7)
imagesc(chick7),colormap(gray),title('chick7')
chick7_bg=chick7(1:200,1:250);
chick7_std=std2(chick7_bg);
chick7_avg=mean2(chick7);
chick7_snr=chick7_avg/chick7_std

%SNR for chick8
chick8=double(dicomread('chicken8.dcm'));
subplot(2,4,8)
imagesc(chick8),colormap(gray),title('chick8')
chick8_bg=chick8(1:200,1:250);
chick8_std=std2(chick8_bg);
chick8_avg=mean2(chick8);
chick8_snr=chick8_avg/chick8_std
```

```
chick1_snr =

    4.9541

chick2_snr =

    5.5503

chick3_snr =

    4.1968

chick4_snr =

    4.0887

chick5_snr =
```

```
    2.8030

chick6_snr =

    3.1723

chick7_snr =

    3.1695

chick8_snr =

    2.5059
```



3. Calculate contrast to noise ratios for the same 8 CT images. Follow the same process to show your work.

Flow chart

1. Read the image file ‘chicken.dcm’ using ‘dicomread’
2. Plot the image
3. Set the background variable
4. Find the standard deviation of chosen background.
5. Calculate CNR by using following equation.

$$CNR=\rho_{max}- \rho_{min}/\sigma(\rho_{bg})$$

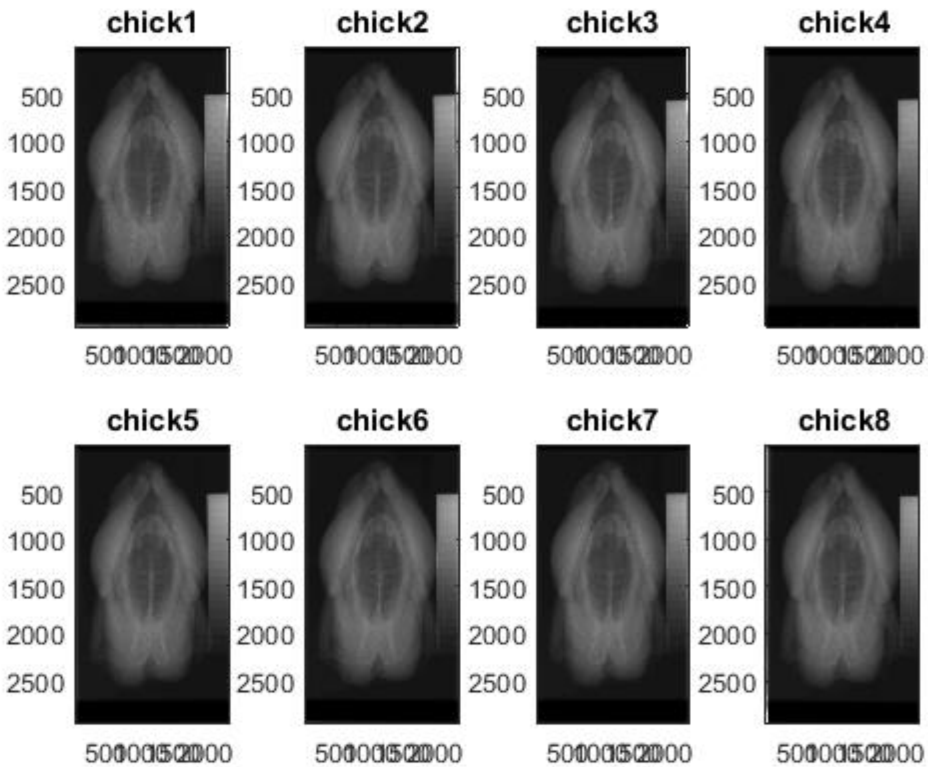
6. Repeat the above steps for 8 CT images.

```
clc

clear all
close all

%CNR for chick1
chick1=double(dicomread('C:\Users\dell\Documents\Masters\Fall 15-1st sem\Matlab
Programs\image_processing_practice\chicken1.dcm'));
subplot(2,4,1)
imagesc(chick1),colormap(gray),title('chick1')
chick1_bg=chick1(1:200,1:250);
chick1_std=std2(chick1_bg);
chick1_max=max(max(chick1));
chick1_min=min(min(chick1))
chick1_cnr=(chick1_max-chick1_min)/chick1_std

%CNR for chick2
chick2=double(dicomread('C:\Users\dell\Documents\Masters\Fall 15-1st sem\Matlab
Programs\image_processing_practice\chicken2.dcm'));
subplot(2,4,2)
imagesc(chick2),colormap(gray),title('chick2')
chick2_bg=chick2(1:200,1:250);
chick2_std=std2(chick2_bg);
chick2_max=max(max(chick2));
chick2_min=min(min(chick2))
chick2_cnr=(chick2_max-chick2_min)/chick2_std

%CNR for chick3
chick3=double(dicomread('C:\Users\dell\Documents\Masters\Fall 15-1st sem\Matlab
Programs\image_processing_practice\chicken3.dcm'));
subplot(2,4,3)
imagesc(chick3),colormap(gray),title('chick3')
chick3_bg=chick3(1:200,1:250);
chick3_std=std2(chick3_bg);
chick3_max=max(max(chick3));
chick3_min=min(min(chick3))
chick3_cnr=(chick3_max-chick3_min)/chick3_std
```

```
%CNR for chick4
chick4=double(dicomread('C:\Users\dell\Documents\Masters\Fall 15-1st sem\Matlab
Programs\image_processing_practice\chicken4.dcm'));
subplot(2,4,4)
imagesc(chick4),colormap(gray),title('chick4')
chick4_bg=chick4(1:200,1:250);
chick4_std=std2(chick4_bg);
chick4_max=max(max(chick4));
chick4_min=min(min(chick4))
chick4_cnr=(chick4_max-chick4_min)/chick4_std

%CNR for chick5
chick5=double(dicomread('C:\Users\dell\Documents\Masters\Fall 15-1st sem\Matlab
Programs\image_processing_practice\chicken5.dcm'));
subplot(2,4,5)
imagesc(chick5),colormap(gray),title('chick5')
chick5_bg=chick5(1:200,1:250);
chick5_std=std2(chick5_bg);
chick5_max=max(max(chick5));
chick5_min=min(min(chick5))
chick5_cnr=(chick5_max-chick5_min)/chick5_std

%CNR for chick6
chick6=double(dicomread('C:\Users\dell\Documents\Masters\Fall 15-1st sem\Matlab
Programs\image_processing_practice\chicken6.dcm'));
subplot(2,4,6)
imagesc(chick6),colormap(gray),title('chick6')
chick6_bg=chick6(1:200,1:250);
chick6_std=std2(chick6_bg);
chick6_max=max(max(chick6));
chick6_min=min(min(chick6))
chick6_cnr=(chick6_max-chick6_min)/chick6_std


%CNR for chick7
chick7=double(dicomread('C:\Users\dell\Documents\Masters\Fall 15-1st sem\Matlab
Programs\image_processing_practice\chicken7.dcm'));
subplot(2,4,7)
imagesc(chick7),colormap(gray),title('chick7')
chick7_bg=chick7(1:200,1:250);
chick7_std=std2(chick7_bg);
chick7_max=max(max(chick7));
chick7_min=min(min(chick7))
chick7_cnr=(chick7_max-chick7_min)/chick7_std

%CNR for chick8
chick8=double(dicomread('C:\Users\dell\Documents\Masters\Fall 15-1st sem\Matlab
Programs\image_processing_practice\chicken8.dcm'));
subplot(2,4,8)
imagesc(chick8),colormap(gray),title('chick8')
chick8_bg=chick8(1:200,1:250);
chick8_std=std2(chick8_bg);
chick8_max=max(max(chick8));
chick8_min=min(min(chick8))
```

```
chick8_cnr=(chick8_max-chick8_min)/chick8_std
```

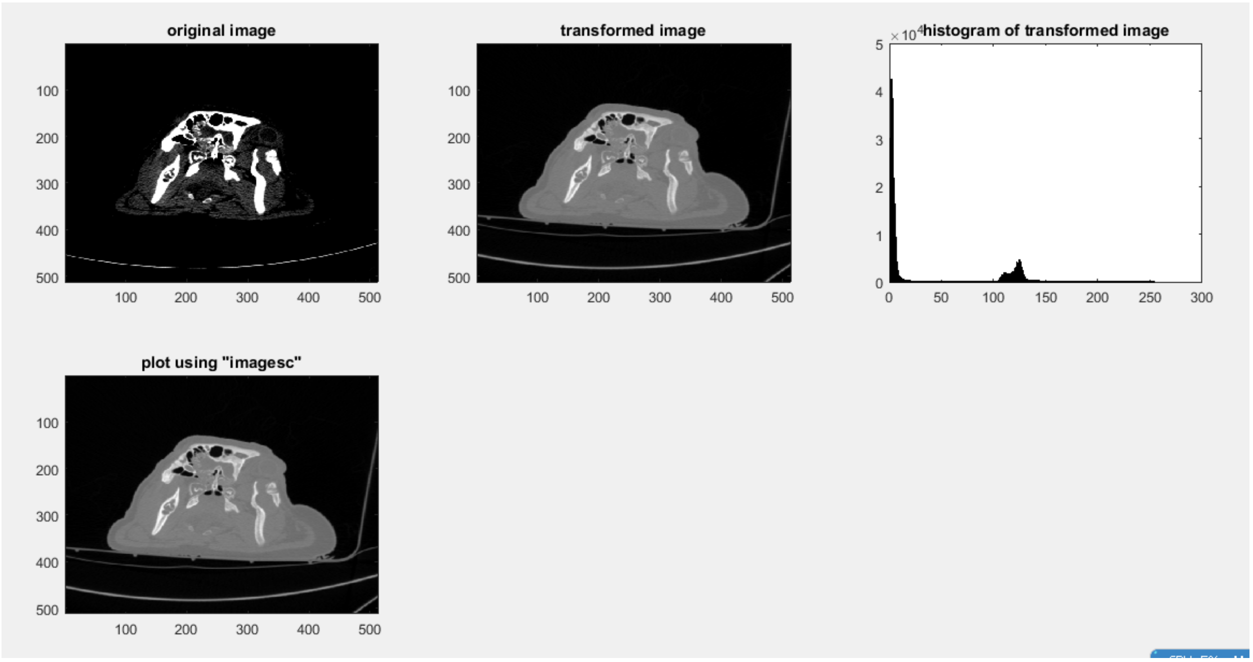
```
chick1_cnr =

    8.9253

chick2_cnr =

   10.0140

chick3_cnr =

    7.6336

chick4_cnr =

    7.4289

chick5_cnr =

    5.0909

chick6_cnr =

    5.7657

chick7_cnr =

    5.7746

chick8_cnr =

    4.5567
```



4. Using linear adjustment of image depth range, plot “PIG_CT” or another image from Chap 4 so that you can enhance the image contrast to show weak spots/areas. Please show your steps and scripts. Also, please compare your results with those obtained with the ‘`imagesc`’ function.

```
clc

clear all
close all
imoriginal=double(dicomread('C:\Users\dell\Documents\Masters\Fall 15-1st sem\Matlab
Programs\image_processing_practice\PIG_CT'));
subplot(2,3,1)
% original image without scaling
image(imoriginal),colormap(gray)
title('original image')
%target=255
imtransformed=255*(imoriginal-min(imoriginal(:)))/(max(imoriginal(:))-
min(imoriginal(:)));
subplot(2,3,2)
image(imtransformed),colormap(gray(256))
title('transformed image')
subplot(2,3,3)
hist(imtransformed(:),255),title('histogram of transformed image')
subplot(2,3,4)
```

```
imagesc(imoriginal),title('plot using "imagesc"')
```



5. Use the windowing technique to process "PIG_MR" or another image so as to improve the image quality and compare your results with '`imagesc`' function. Please show histograms before and after your operation. Show your steps, script, and results (both figures and images).

```
clc

clear all
close all
imoriginal=double(dicomread('C:\Users\dell\Documents\Masters\Fall 15-1st sem\Matlab
Programs\image_processing_practice\PIG_CT'));
subplot(3,3,1)
% original image without scaling
image(imoriginal),colormap(gray)
title('original image')
%target=255
imtransformed=255*(imoriginal-min(imoriginal(:)))/(max(imoriginal(:))-
min(imoriginal(:)));
subplot(3,3,2)
image(imtransformed),colormap(gray(256))
title('transformed image')
subplot(3,3,3)
hist(imtransformed(:),256)
title('histogram of transformed image')
subplot(3,3,4)
imagesc(imoriginal),colormap(gray)
```

```
title('using imagesc func')
omega=127;
sigma=40;
imsigmoid=255./(1+exp(-1*(imtransformed-omega)/sigma));
subplot(3,3,5)
image(imsigmoid)
colormap(gray(256))
title('sigmoid trasformation image')
subplot(3,3,6)
hist(imsigmoid(:),256),title('hist of sigmoid')
```