HOMEWORK 7

SOLUTIONS

1. Use both the windowing technique and sigmoid function to process Chap. 4 "LungCT.dcm" to improve the image quality and compare your results between the two cases. You are not allowed to use 'imagesc' function. Please show histograms before and after your operation for both cases, with a bar range of 64. Show your steps, script, and results (both figures and images).

Solution:

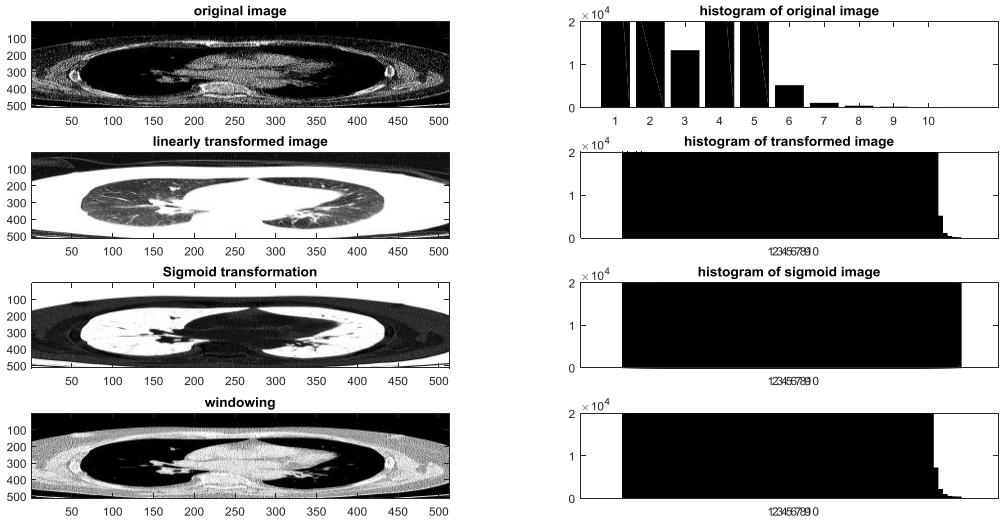
Editor - C:\Users\dell\Documents\Masters\Fall 15-1st sem\Matlab Programs\HW_7_26_Oct_15\que_1.m

lintrans.m | practice_image_intensity_Chap4_2.m | que_2.m | sigmoid.m | que_1.m

```
clc
clear all
close all
%to plot original image
original=double(dicomread('LungCT.dcm'));
colormap(gray)
subplot(4,2,1)
image(original)
title('original image')
%histogram of original image
subplot(4,2,2)
bar(hist(original(:)));
ylim([0 2*10^4]);
title('histogram of original image')
trans=((original-min(original(:)))./(max(original(:))-min(original(:)))).*256;
subplot(4,2,3)
image(trans)
title('linearly transformed image')
%histogram of lineraly transformed
subplot(4,2,4)
bar(hist(trans(:)),64);
ylim([0 2*10^4]);
title('histogram of transformed image')
%sigmoid transformation
omega=30;
sigma=20;
```

```
27 -    sigmoid=256./(1+exp((trans-omega)./sigma));
28 -    subplot(4,2,5)
29 -    image(sigmoid)
30 -    title('Sigmoid transformation')
31      %histogram of sigmoid
32 -    subplot(4,2,6)
33 -    bar(hist(sigmoid(:)),64);
34 -    ylim([0 2*10^4]);
35 -    title('histogram of sigmoid image')
36      %windowing
37 -    thre_high=200;
38 -    thre_low=70;
39 -    for i=1:512
40 -      for j=1:512
41 -         if trans(i,j)>= thre_high
42 -            trans(i,j) = 255;
43 -         else if trans(i,j) <= thre_low
44 -            trans(i,j) = 0;
45 -             else
46 -            trans(i,j)=(trans(i,j)-thre_low)*256/(thre_high-thre_low);
47 -             end
48 -         end
49 -      end
50 -    end
51 -    subplot(4,2,7)
52 -    image(trans),title('windowing')
```

```
53      %histogram of window
54 -    subplot(4,2,8)
55 -    bar(hist(trans(:)),64);
56 -    ylim([0 2*10^4]);
```



2. Please load an image file, 'SKULLBASE.DCM', given in "Data_for_image" folder for Chap 4. Then perform the following tasks:
   (1) Make two separate functions, one for linear ITF and one for sigmoid-based (or windowing) ITF;
   (2) Plot multiple figures on a single page, including (a) the original image figure, (b) linear ITF to show the image with a good contrast, (c) sigmoid-based ITF by choosing appropriate omega and sigma values, and (d) an image with good contrast for dark regions using log scales.
   (3) Plot corresponding histograms for the four figures obtained above.

Solution:

Editor - C:\Users\dell\Documents\Masters\Fall 15-1st sem\Matlab Programs\HW_7_26_Oct_15\que_2.m

lintrans.m | que_2.m | sigmoid.m | que_1.m

```
clc
clear all
close all
ima=lintrans('SKULLBASE.DCM');
im=sigmoid('SKULLBASE.DCM');

```

lintrans.m | que_2.m | sigmoid.m | que_1.m

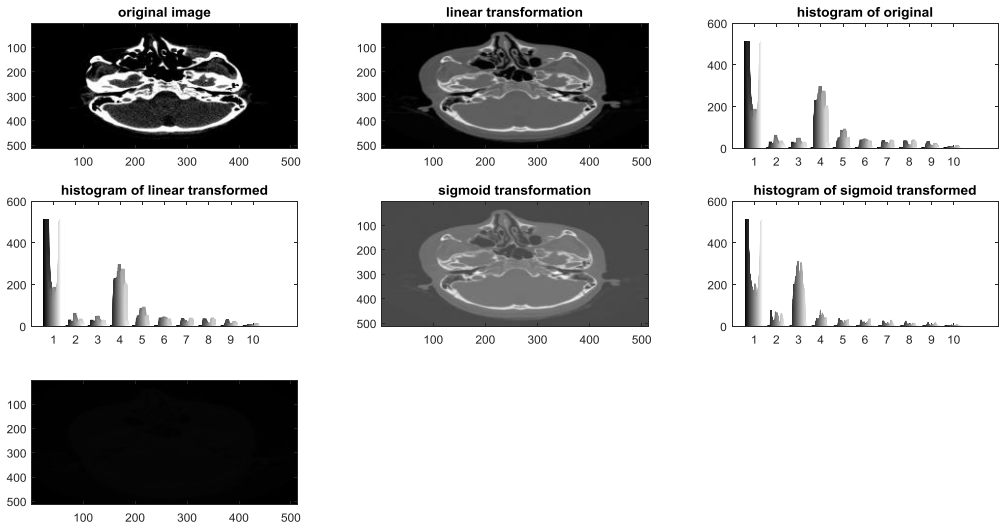
```
function z = lintrans(ima);
z = single(dicomread(ima));
%original image
subplot(3,3,1)
image(z)
title('original image')
%linear transformation
trans = ((z-min(z(:)))/((max(z(:))-min(z(:)))).*256;
subplot(3,3,2)
image(trans)
colormap(gray(256))
title('linear transformation')
subplot(3,3,3)
bar(hist(z),64)
title('histogram of original')
subplot(3,3,4)
bar(hist(trans),64)
title('histogram of linear transformed')
logtr=log(z+1025);
subplot(3,3,7)
image(logtr)

```

lintrans.m | que_2.m | sigmoid.m | que_1.m

```
function sig=sigmoid(im);
sig = single(dicomread(im));
omega=250;
sigma=200;
%sigmoid transformation
trans = ((sig-min(sig(:)))/((max(sig(:))-min(sig(:)))).*256;
sigtrans = 256./(exp(-((trans-omega)./sigma)));
subplot(3,3,5)
image(sigtrans)
title('sigmoid transformation')
colormap(gray(256));
subplot(3,3,6)
bar(hist(sigtrans))
title('histogram of sigmoid transformed')

```



3. Use the same image file of "LungCT.dcm", write a function that allows you to plot multiple images with 4-5 different windowing settings so that you can decide which setting gives you a best image contrast. (You can judge the image quality visually.) Also, you need to plot an image in the log scale and comment on if the use of log scale can improve the image contrast.

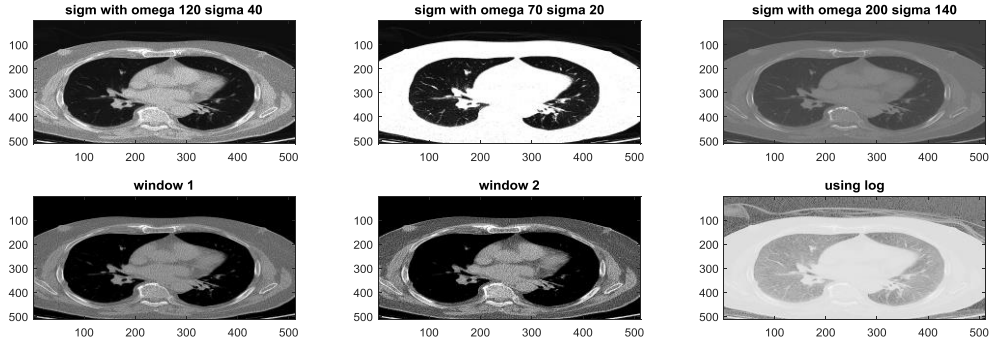
Solution:

que_2.m | sigmoid.m | que_1.m | bmode.m | sigm.m | que_3.m | DemoEnvelope.m

```
clc
clear all
close all
sig=sigm('LungCT.dcm');
```

que_2.m | sigmoid.m | que_1.m | bmode.m | sigm.m | que_3.m | DemoEnvelope.m

```
function sig=sigm(im);
sig = single(dicomread(im));
omega1=120;
sigma1=40;
%sigmoid transformation
trans = ((sig-min(sig(:)))/(max(sig(:))-min(sig(:)))).*256;
sigtrans1 = 256./(exp(-((trans-omega1)./sigma1)));
subplot(3,3,1)
image(sigtrans1)
title('sigm with omega 120 sigma 40')
colormap(gray(256));
omega2=70;
sigma2=20;
sigtrans2 = 256./(exp(-((trans-omega2)./sigma2)));
subplot(3,3,2)
image(sigtrans2)
title('sigm with omega 70 sigma 20')
subplot(3,3,3)
omega3=200;
sigma3=140;
sigtrans3 = 256./(exp(-((trans-omega3)./sigma3)));
subplot(3,3,3)
image(sigtrans3)
title('sigm with omega 200 sigma 140')
trans4=2.56*trans-128;
subplot(3,3,4)
image(trans4)
title('window 1')
trans5=5.12*trans-384;
subplot(3,3,5)
image(trans5)
title('window 2')
logtr=log(sig+1025);
subplot(3,3,6)
imagesc(logtr)
```


sigm with omega 120 sigma 40
sigm with omega 70 sigma 20
sigm with omega 200 sigma 140
window 1
window 2
using log
100
200
300
400
500