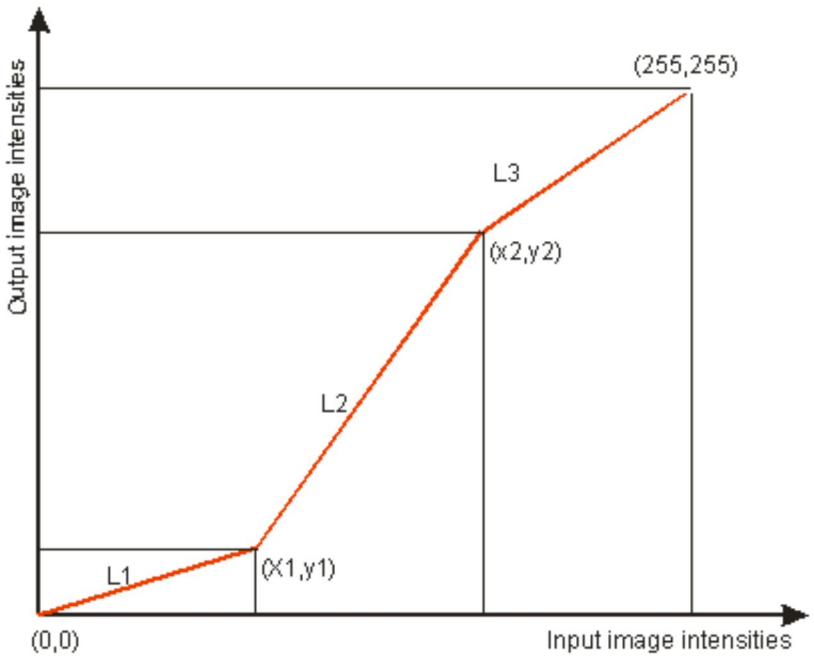
Thilina's Blog

Hope this will work..

Contrast Stretching for Gray Scale images with MATLAB

When studying "Introduction to Image Processing and Machine vision" and "Bio Medical Engineering and Instrumentation" for the end semester exam, I read a small section related to those two modules which can be easily implemented using MATLAB. "Contrast Stretching" is a simple piecewise linear transformation function (http://en.wikipedia.org/wiki/Piecewise_linear_function) which expands the range of intensity of the image to user defined span.

Simple mathematical illustration of the process is as below.



(http://thilinasameera.files.wordpress.com/2011/03/clip_image002.gif)

Considering Line L1; $y = \frac{y1}{x1}x$ (http://thilinasameera.files.wordpress.com/2011/03/clip_image004.gif)

Considering Line L2;

$$y = \frac{y2-y1}{x2-x1}.x + y1$$

(http://thilinasameera.files.wordpress.com/2011/03/clip_image006.gif)

Considering Line L3;

$$y = \frac{255-y2}{255-x2}.x + y2$$

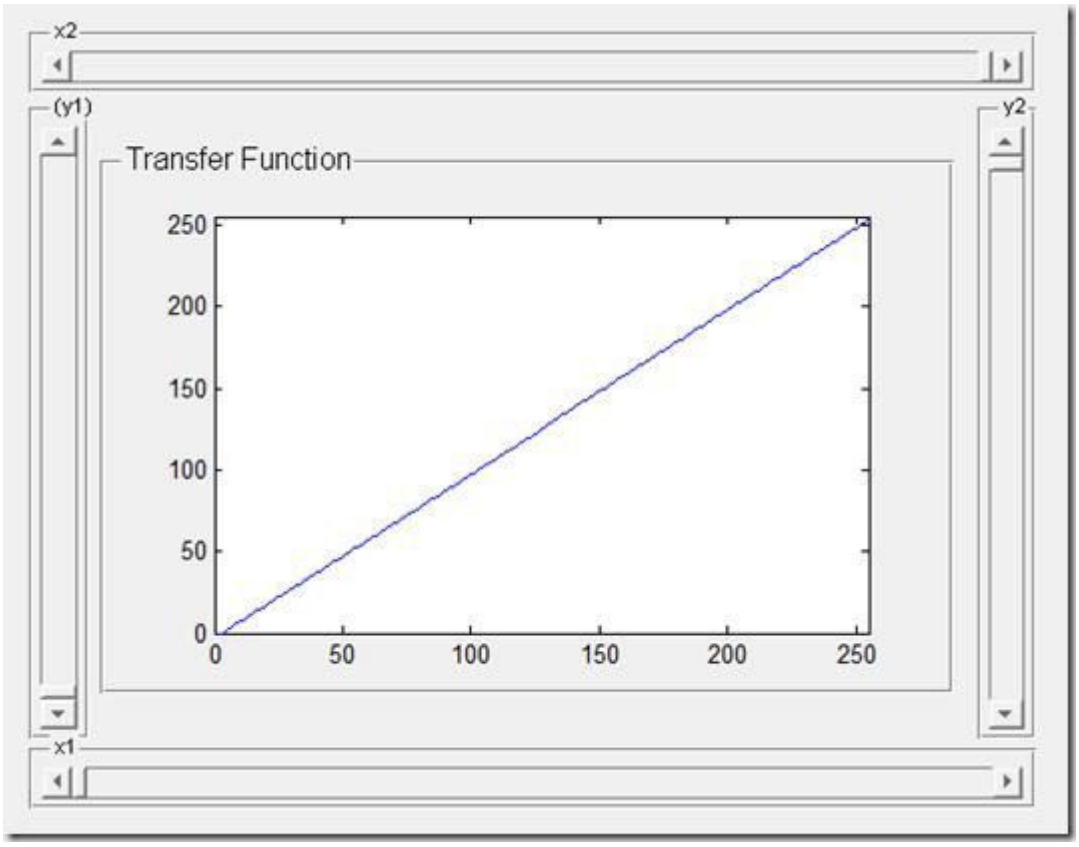
(http://thilinasameera.files.wordpress.com/2011/03/clip_image008.gif)

Therefore the piecewise transform function can me defined as follows;

$$y = \begin{cases} \frac{y1}{x1}x, & 0 \le x \le x1 \\ \frac{y2-y1}{x2-x1}x + y1, & x1 < x < x2 \\ \frac{255-y2}{255-x2}x + y2, & x2 < x < 255 \end{cases}$$

(http://thilinasameera.files.wordpress.com/2011/03/clip_image0021.gif)

When jumping to the implementation on MATLAB I used 4 sliders to define the x1, x2, y1 and y2 values and displayed the resulting line with the aid of plot function. And they are converted to plot and finally for modified the image output as follows;



(http://thilinasameera.files.wordpress.com/2011/03/clip_image012.jpg)

```
% Thilina S. Ambagahawaththa
% 2011-03-23
% breaking points from gui
x1 = floor(get (x_1,'Value'));
x2 = floor(get (x_2,'Value'));
y1 = floor(get (y_1,'Value'));
y2 = floor(get (y_2,'Value'));

% range definitions
x_r1 = 0:x1;
x_r2 = x1:x2;
x_r3 = x2:255;

% line gradients
a1 = y1/x1;
a2 = (y2-y1)/(x2-x1);
a3 = (255-y2)/(255-x2);

% line functions
yo_1 = floor(a1*x_r1);
yo_2 = floor(y1 + (a2*(x_r2-x1)));
yo_3 = floor(y2 + (a3*(x_r3-x2)));

% line concatance
y = [yo_1 yo_2 yo_3];

% plot line
subplot(1,1,1,'Parent',fg);
plot(y);
xlim([0 255]);
ylim([0 255]);

try % if image is loaded

    % mask images for colour intensity regions
    mask_1 = double(imageIn<=x1);
    mask_2 = double((imageIn>x1)&(imageIn<x2));
    mask_3 = double(imageIn>=x2);

    % contrast stretching in regions
    im1 = mask_1.*floor(a1*imageIn);
    im2 = mask_2.*floor(y1 + (a2*(imageIn-x1)));
    im3 = mask_3.*floor(y2 + (a3*(imageIn-x2)));

    % concatance of output image
    imageOut = cast(im1+im2+im3,'uint8');


```

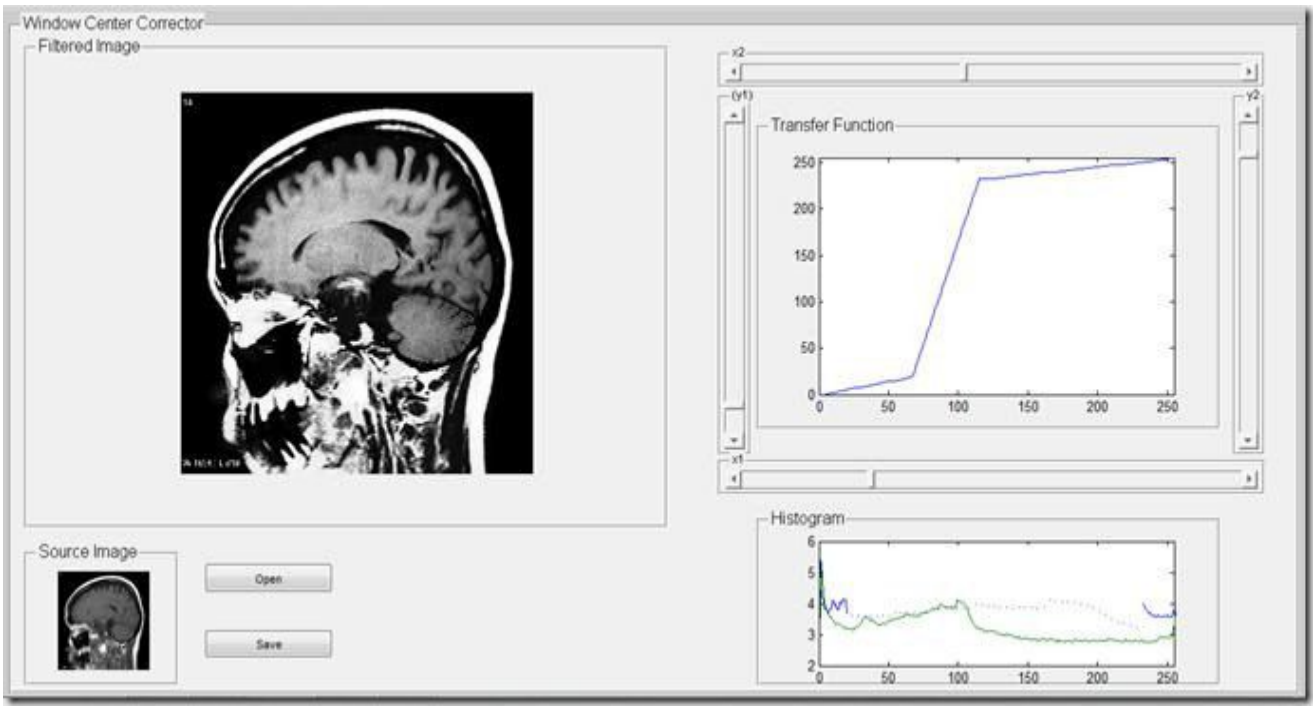
```
        % show output image
        subplot(1,1,1,'Parent',ck);
        imshow(imageOut);

        % image histogram generation
        histo1 = log10(imhist(imageOut));
        histo2 = log10(imhist(cast(imageIn,'uint8')));
        subplot(1,1,1,'Parent',bg);
        hgrm = [histo1,histo2];
        plot(hgrm);
        xlim([0 255]);

    catch e %image not loaded

    end
```

Following Image demonstrates a small application written using above technique, the test image is downloaded from this link (http://radiopaedia.org/images/21401) via google search (http://www.google.lk/imgres?imgurl=http://images.radiopaedia.org/images/21401/4faeaf8a3c7b732bf9103e3d17f54d.jpg&imgrefurl=http://radiopaedia.org/images/21401&usg=__12CyopGCAymzdOPVjp2_Y9ASc3w=&h=938&w=912&sz=95&hl=en&start=41&zoom=1&tbnid=ckqGV0HlGA-s9M:&) and you can directly download image from here (http://images.radiopaedia.org/images/21401/4faeaf8a3c7b732bf9103e3d17f54d.jpg).



(http://thilinasameera.files.wordpress.com/2011/03/clip_image014.jpg)

Thank you for reading ..!

2011 March 23 - Posted by Thilina S. | Image Processing, MATLAB

8 Comments »

1. it realy nice…….
   thanks for help……

   Comment by saroj hatheele | 2011 August 9 | Reply

   - Thank you very much for the comment .!

     Comment by Thilina S. | 2011 August 9 | Reply

2. I can't show the image to the axes which you showed in Filtered Image like you. Can you help me?

   Comment by Hoang | 2011 December 16 | Reply

3. That's great, Yours blog relating matlab image processing are really amazing.

   Comment by bakhtazam | 2012 October 13 | Reply

4. what is fg of the line subplot(1,1,1,'Parent',fg);

   Comment by Sumii | 2012 November 10 | Reply

   - Parent zurgiin format ni yum bishuu suumii

     Comment by Tulgaa | 2012 November 12 | Reply

5. may i have ur email plz, i need ur help with my program

   Comment by Iora Omair | 2013 March 5 | Reply

6. thank's

   Comment by sangwidyimoezt | 2013 June 26 | Reply

About

I am Thilina Sameera from Sri Lanka. I completed my undergraduate studies on Electronic and Telecommunication Engineering in University of Moratuwa and currently doing my post graduate studies on Computer Vision and Processor Design at the Department of Electronic and Telecommunication Engineering, University of Moratuwa. I am working as a Biomedical Research Engineer at "Premium International – University of Moratuwa, Research and Development Laboratory for Biomedical Technologies" at the Department of Electronic and

Telecommunication Engineering, University of Moratuwa.

Site info

Thilina's Blog
The Andreas04 Theme.