Assignment 2

Question 1 :

The Windowing algorithm was implemented with the algorithm as specified in the presentation. The values W and L , however, had to be changed to make the image more visually palatable.

For Example, the input image for this question was :

This was put through Windowing of two different ranges

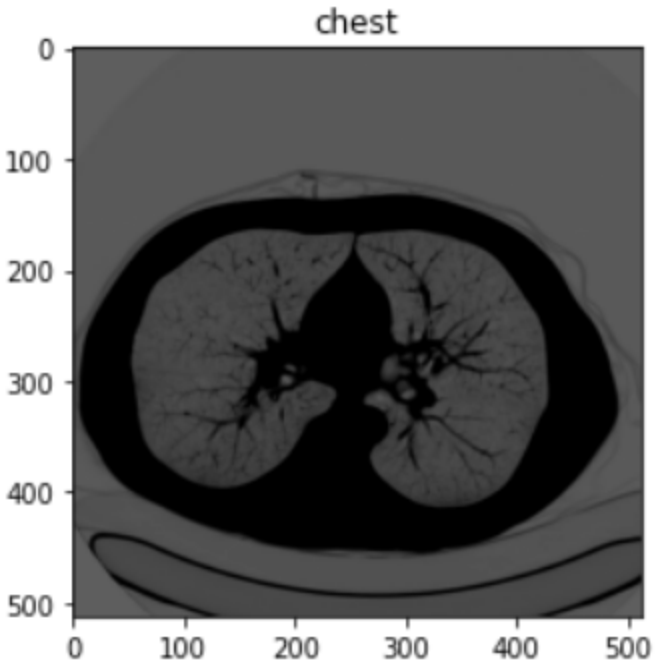
1. For bringing out the Bones (1800, 600)

2. For Bringing out the chest (400, 250) . It could be doubted here that , instead of faithfully showing the chest tissue linings, this could be introducing artifacts etc (blurring, non original capillaries etc) in the image. These will have to be taken care of .

CONCLUSIONS :: Different parts of the image show their detail at different values of W , L. This is due to the fact they all have different Honsfield unit measures.

SUGGESTIONS / RECOMMENDATIONS :

- We tried a new way of applying the windowing measure. We set the values as (1500, -200). And then we took the negative of that image. That gave us a seemingly improved way of showing the chest portion of the scan.



Here, here we seem to be able to capture the linings of the chest tissue very well. They are marked as dark outlines on a white background. This could, however, be just a matter of coincidence, or maybe we could start looking at different ways

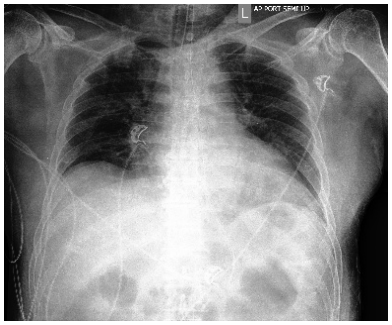
of applying the windowing operation on the scans to bring out the finer details in a better manner.

QUESTION 2 :

Implementing the MUSICA Algorithm.

Since this was not done fully in class, we had to go through the paper uploaded on Moodle. From there, we understood the Laplacian Pyramid reconstruction and seek to understand how to implement the non linear mask.

Below here, we shall show the effect of the MUSICA algorithm.



AND

These images have been passed through the MUSICA Algorithm which worked with 20 layers. And the p value was tried at various numbers and finally , for these images, set at 0.5

CONCLUSIONS :

We see that the MUSICA Algorithm has been phenomenal in dealing with the contrast issues and helps in seeing the various parts of the image more clearly.

SUGGESTIONS / RECOMMENDATIONS :

We have to note here that , inherently in the algo, there is not way to check if the contrast is excess etc. For these purposes, there have to be changes made to this already good algo to make it truly world class.

QUESTION 3 :

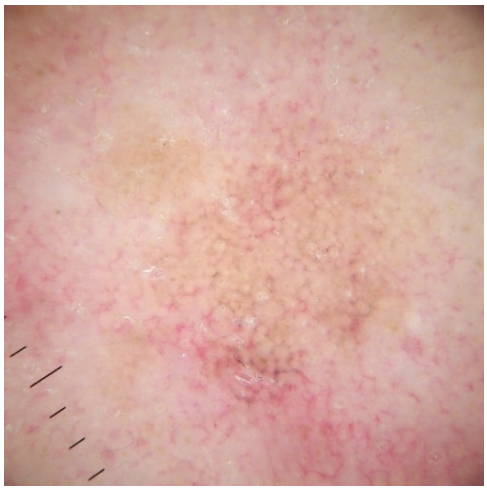
Here, we look to implement the retinex algorithm . Here, we

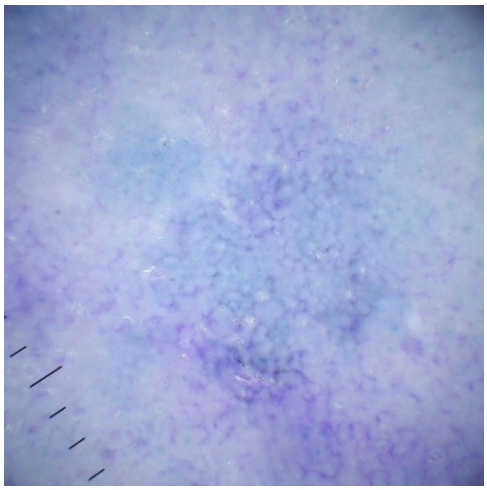
1. Take the input image
2. Blur it (using Gaussian blur in our case)
3. Take log and subtract it. This gives luminance
4. Then add the negative of this luminance to the inital image

This should give you a refined image with better visible fringes

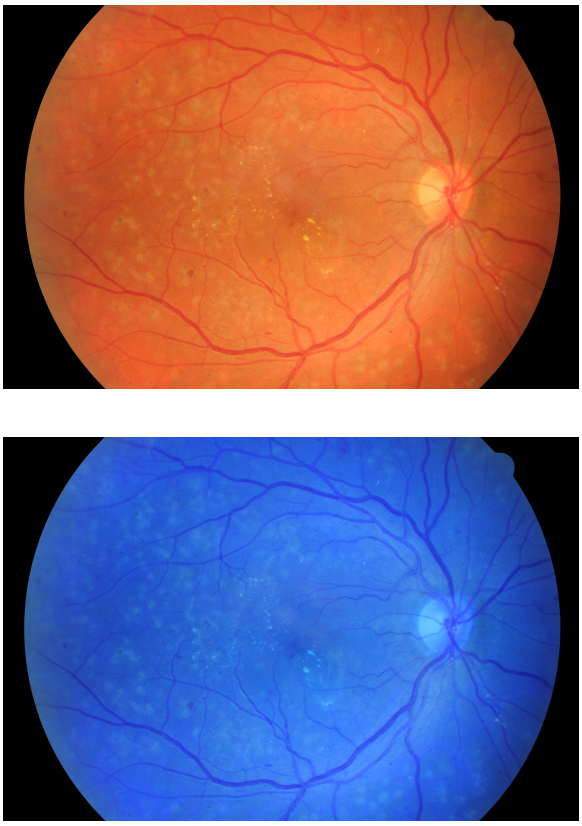
Here are the instances of our usage of the RETINEX algoritm

- Skin

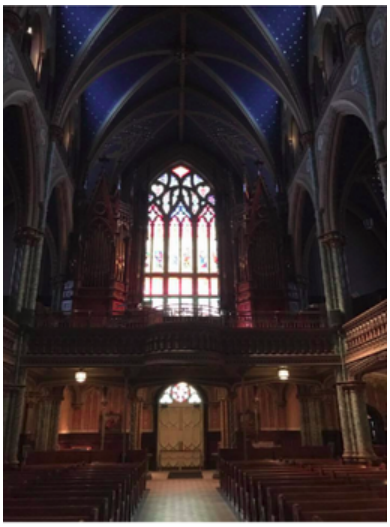




- Retina



- Test Image



Here, it is to be noted that the result images appear Blue because they are saved using CV2, whilst they were generated using Matplotlib. Matplotlib stores images using RGB format, whereas CV2 stores images in the BGR format.

CONCLUSION :

We conclude that Retinex can be used to work with the illumination factors in order so as to better display the images.

SUGGESTIONS / RECOMMENDATIONS :

To be very fair, these images (with the removal of the blue factor from the CV2, plt differences) are not very different from their originals. Thus, some changes need to be made so that the changes can be more pronounced.

QUESTION 3 B

Here, we implement the paper that was listed in the assignment to implemented.

We see that the algorithm tries to find normalizing factors for each channel of the image.

Once we get that, using sampling factors taken radially inverse proportionately from the center (because of non uniform illumination , less light is received from the peripherals of the image. However, for this very reason, we take more sampling from the outer region of our sampling)

Once all this is done, and we have taken our normalizing factors, we obtain our final image by applying the point transformation to each pixel of our input image.

Following are the images that we ran the algo on (Along with the results that we got):

CONCLUSION :

The Algo in the paper is much better than RETINEX at bettering the images and making them more suitable for usage my medical professionals

RECOMMENDATION :

This algo depends massively on the radial sampling of the image. One issue with that is that it is based on (R, Theta)
This means that ultimately, what we are getting is an approximation of the luminance factor that we could have gotten. Hence, we can say that there is ground for improvement