Medical Image enhancement using different Image Processing procedures

Introduction to Image and Video Processing project 2017

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***Abstract*—In this paper, several Image Processing procedures were implemented on some medical images for better understanding. Histogram equalization, filtering with different kernels, Gray level transformations, modifications in the HSV space, and in RGB space are the major techniques that were used to enhance images. The output results give more insights about the images and enhance the overall scope of finding more perceptions.**

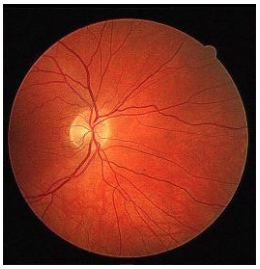
I. INTRODUCTION

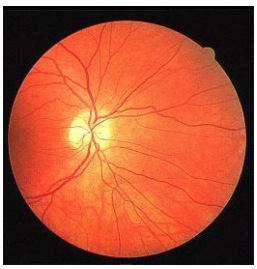
Most of the medical images that are taken raw are often not clear as experts would like to have which hampers taking vital decisions. So, running those images through some image processing algorithms can ease the procedure in a great extent. In this project, some real-life medical images are taken from several medical image datasets and enhanced by altering some fundamental properties of the images that help to bring more insights which are very hard to see through the naked eye (raw images). In total 5 operations were done on 10 different images which are briefly discussed below.

II. OPERATIONS

A. *Operaion 1 : (Laplacian+Edge Detection)*

In the first operation, two input images of Retina are taken as input and the in the raw images, the veins are not visible clearly. After using a sharpening filter (Laplacian) with different kernels the veins become more visible. Moreover, to see the vein paths, edge detection method "Sobel" was used.





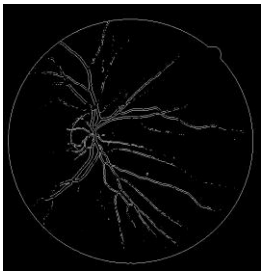
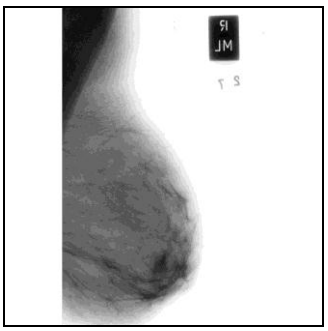


Figure 1: a|b|c|d : Input Retina image, Laplacian kernel center value 8, Laplacian Kernel center value 9, Sobel Edge Detection.

B. *Operation 2 : (Gray level transformation + Laplacian)*

In the second operation, input images are some Mammography pictures of breast cancer. The infections are very unclear in the raw image but after applying some processing - making the image negative and sharpening it using different center values of kernels make the images more clear and the infections are also visible quite clearly.



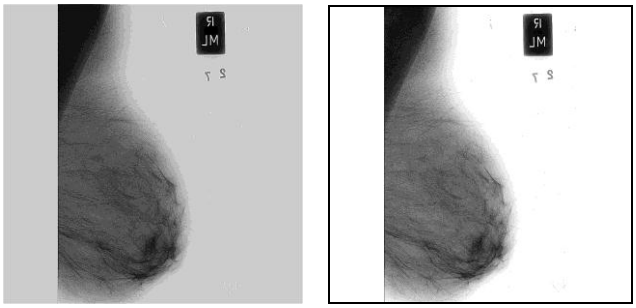
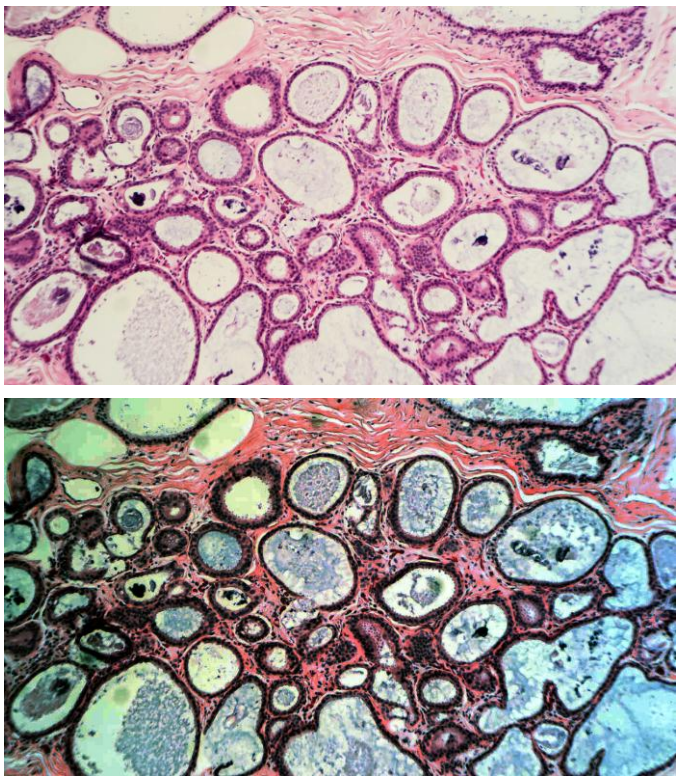


Figure 2: Breast cancer detection a|b|c|d: Input image, Negative image, Laplacian with c. value 8.8 , Laplacian with c. value 9.

C. Operation 3 : (Histogram equalization in HSV + intensity increase in HSV)

For the third operation, the input images are colored cancer cells. To enhance the images, first, the images are transferred to HSV color space and then apply the histogram equalization method on the image. It balances the grey level intensities of the image. Moreover, only the intensity of the image is increased so that more details are visible.



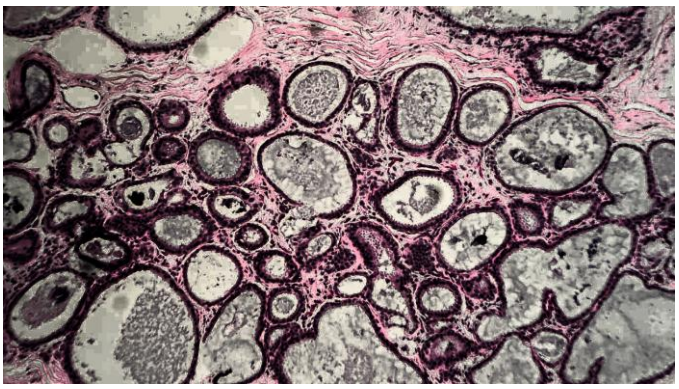


Figure 3- Cancer cell; a|b|c: Input image, Image after histogram equalization in HSV, Image after increasing the intensity in HSV space.

Clearly, from the figure 3, it is seen that in last two pictures, more details in the cell body are visible.

D. Operation 4 : (Histogram equalization+ Negative image)

In this operation, I use two different types of images - an image of a close-up shot of skin disease and another - x-ray of the upper leg and knee. For both of the images, first, the image is transformed into a gray image in order to apply histogram equalization. Then, the negative of the image is taken.

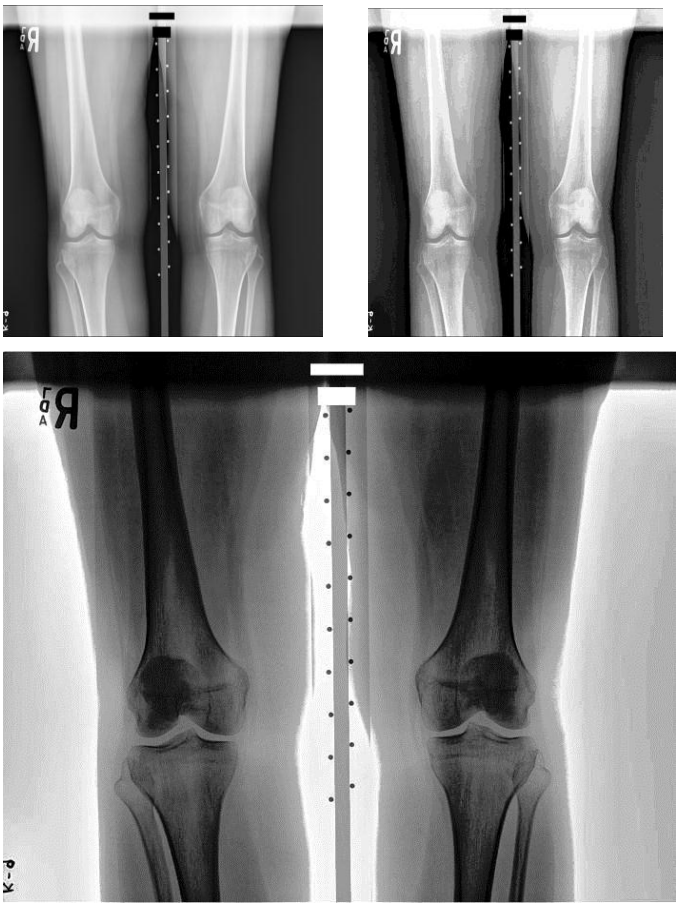


Figure 4- Bone X-ray; a|b|c: Input image, Histogram equalized image, Negative of the histogram eq. image.

Figure 5- Skin disease identification; a,b: Input image, Negative histogram equalized image.

E. Operation 5 : (Histogram equalization + Laplacian)

In operation 5, the input images are X-ray images of lungs. It is necessary to do some enhancement operations to have better insights about the images. First, histogram equalization is implemented and then to sharpen the image, laplacian filter using different suitable kernel values are used. The outputs show more detailed picture than the original one.

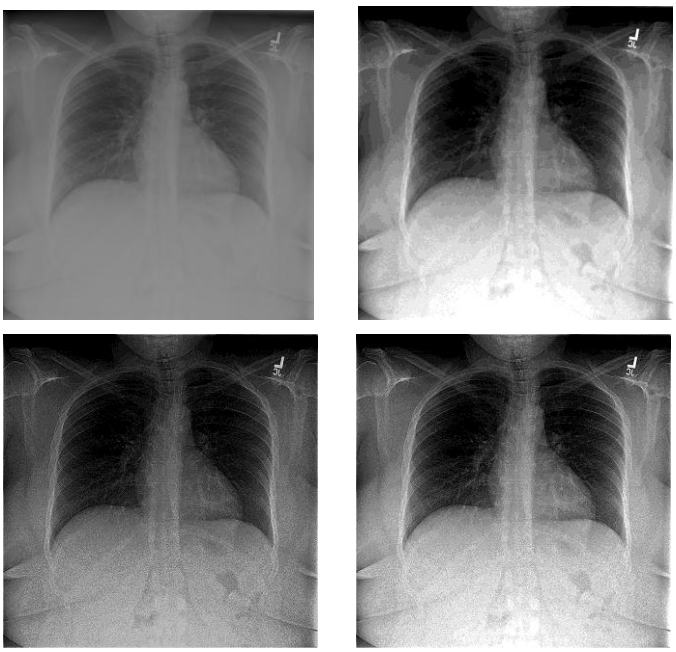


Figure 6- Enhancing X-ray of Lungs; a|b|c|d: Input image, Histogram equalized image, Laplacian with kernel c. value 8.7, Laplacian filter with kernel c. value 9.

III. CONCLUSION

It is clear from the above discussion that applying appropriate image processing tools can help figure out enhanced details from medical images which can be very useful for the experts.

REFERENCES

All the medical images were downloaded from the Open access medical repositories.

[1] STARE: Structured Analysis of the Retina. (http://cecas.clemson.edu/~ahoover/stare/).

[2] The mini-MIAS database of mammograms. (http://peipa.essex.ac.uk/info/mias.html).

[3] The Cancer Imaging Archive (TCIA). (http://www.cancerimagingarchive.net/)