IVP PROJECT

PSEUDO COLOR IMAGE PROCESSING

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ALGORITHM

1. Test image is read and passed through a weighted Gaussian Low Pass Filter.
2. The image is then converted to its binary form and processed on by opening and closing operations.
3. Once the tumor is distinguishable, using grids find the co-ordinates of the ROI enclosing the tumor.
4. Extract the tumor using the co-ordinates and stretch it for better medical examination.
5. For pseudo coloring, pass ROI through the pseudo coloring function [1, 2].
6. Stitch the pseudo colored ROI on the input image and save the stitched image.

RESULTS

A CT scan of human lung with cancer in left lung was taken for this study as shown in Figure 1. To smooth out the image, the image was passed through Gaussian Low Pass Filter and Figure 2 was obtained. After processing the filtered image by a nonlinear (here we used sinusoidal) pseudo coloring function we got an output as depicted in Figure 8. A better distinguished tumor is seen when the image is equalized, the change can be noticed on visual examination of figure 10.

To get the region of interest (ROI), the image is processed on by many morphological operations like closing and opening (only after the image is converted to its binary form), refer Figure 3. ROI is located by a mechanical method that uses the inputs provided by the user based on visual interpretation (Figure 4). The extracted ROI and the expanded form is shown in figure 6.

CONCLUSION

Human can distinguish between thousands of color shades and intensities, compared to about two dozen shades of grey and this fact is used to getter more information from a grayscale CT scan. The tumor has different shades of distinguishable colors and is easier for further medical assessment as compared to a normal grayscale scan. The muscle definition in the surrounding of the tumor can also be studied and examined for the level of damage, this becomes a bit difficult in a grayscale scan. If we only process the tumor and its immediate surrounding, the processing time is reduced and so is the space required for storage. As the color profile of the unaffected muscles won't change much, the pseudo colored ROI can be stitched back on the image instead of processing the entire image. (see Figure 8 & 9)

INNOVATION

By only processing the ROI obtained by visual inspection and morphological processing, the elapsed time could be cut short as a smaller number of pixels have to be processed as unaffected area would have a similar color profile.

Figure 1 Sample input

Figure 2 Gauss LPF image

Figure 3 Stages of Morphological processing

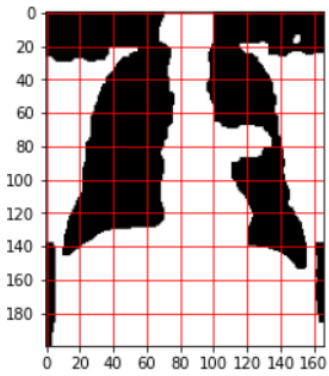

Figure 4 ROI location

Figure 5 Sobel edge detection

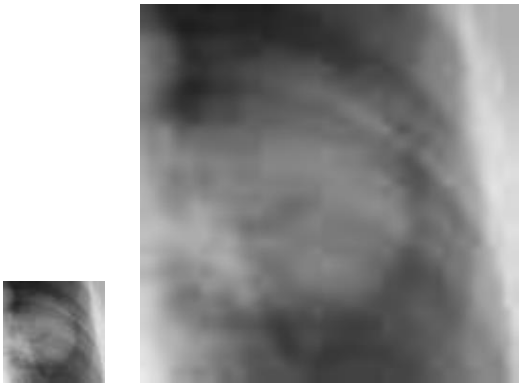

Figure 6 Extracted ROI

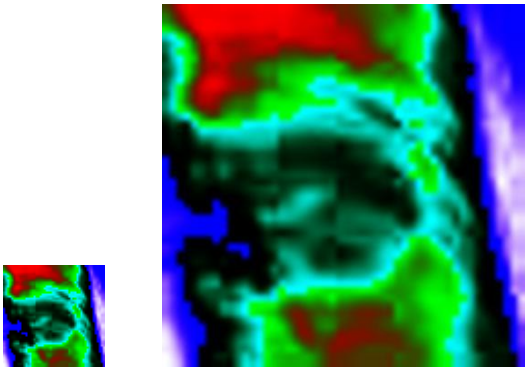

Figure 7 Pseudo colored ROI

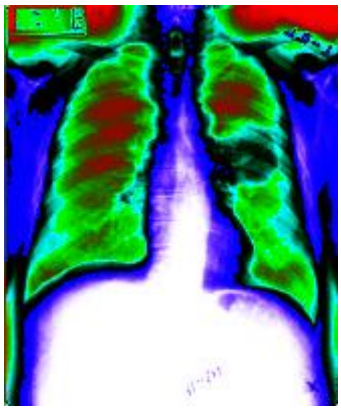

Figure 8 Pseudo colored image

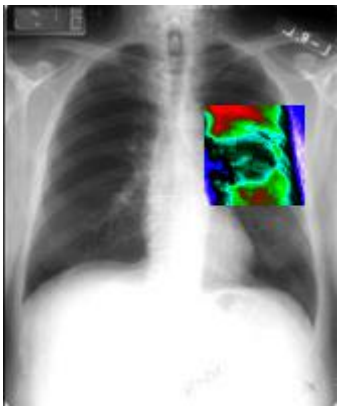

Figure 9 Pseudo colored ROI image

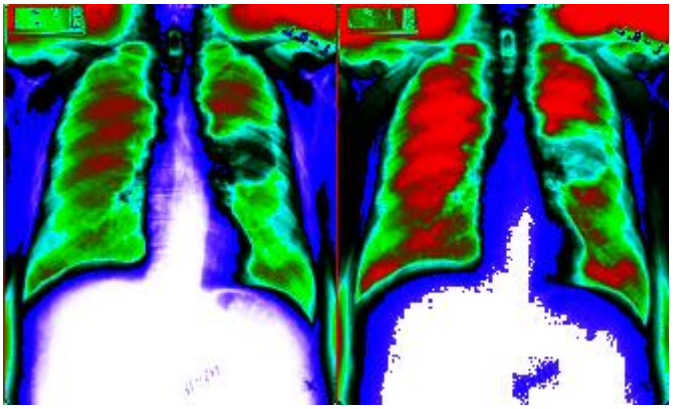

Figure 10 Pseudo colored images with(right) and without(left) histogram equalization

REFERENCES:

[1] L. Jinxiu, L. Junli and W. Ping, "Pseudocolor Coding of Medical Images Based on Gradient," *2007 1st International Conference on Bioinformatics and Biomedical Engineering*, Wuhan, 2007, pp. 932-935.

[2] R. S. Raghuvanshi and A. Datar, "Comparison of gradient operator based pseudocolored enhanced medical images," *2013 Fourth International Conference on Computing, Communications and Networking Technologies (ICCCNT)*, Tiruchengode, 2013, pp. 1-5.