CHAPTER X

CONCLUSION

10.1 Introduction:

Pneumonia is a deadly disease in the world and it mainly affects the children. The infection is diagnosed by the Physician by taking the chest X-Ray of the patients. The main focus of this research work is to implement the importance of Colorization procedure in gray scale X-Ray images and to calculate the severity of the Pneumonia infection. The results from this research work shows the importance of color in gray scale X-Ray images than the ordinary gray scale image. The X-Ray images which are taken into consideration for this research work are the Chest X-Ray images from Oxy Clinical Laboratory and Biopsy Centre, Madurai. The samples used are real time images of the infected persons.

This proposed work consists of two subdivisions. In the first section the gray scale X-Ray image undergoes two colorization process such as with Reference image alone and with Luminance checking. In this colorization process, the second method of Luminance checking yields better results. After colorization, the colored X-Ray image undergoes segmentation by Fuzzy C-Mean algorithm and in the last step the severity finding of the infection is determined. This procedure is repeated for the gray scale X-Ray image also. In the Performance Evaluation chapter the results of both the colorized and gray scale processed images are compared and their performance is evaluated.
In the colorization process, two algorithms are compared and analyzed. In this first algorithm of colorization of gray scale images with Reference image, the gray scale X-Ray image is first converted into ycbcr color space. Y is the luma component and CB and CR are the blue-difference and red-difference chroma components. Then normalization process is done with this. Finally after comparison with luminance part, the gray scale image is converted into color image.

In the second algorithm, the chrominance checking is used for converting the gray scale image to color image. At first, the gray scale image is converted into XYZ color space. The XYZ color space is an international standard developed by the CIE. This model is based on three hypothetical primaries, XYZ, and all visible colors can be represented by using only positive values of X, Y, and Z. The CIE XYZ primaries are hypothetical because they do not correspond to any real light wavelengths. The Y primary is intentionally defined to match closely to luminance, while X and Z primaries give color information. The main advantage of the CIE XYZ space is that this space is completely device independent. Finally the chrominance is checked with the Reference image and the processed image.

This algorithm of chrominance checking gives better result than the first algorithm of reference only, from the results produced in Chapter VI. The next chapters are denoted for the discussion of converting the colorized image into ROI Segmentation and at last the severity of the infection is calculated.
The colored X-Ray undergoes Fuzzy C-Means clustering mechanism for effective segmentation. The results of this segmentation is used to trace out the affected part in the lung area.

The entire process which is discussed above is done both for colored and gray scale images. The results summarized in the chapter IX shows that the colored X-Ray images gives better infection accuracy than the results got from the gray scale images. A sincere attempt was made to document the colorization and segmentation algorithms both theoretically and empirically with rigorous mathematical formulation wherever possible.

The process of colorizing the gray scale X-Ray image is a new attempt and there is no similar research work done earlier. The colorization is done for old scenery images, X-Ray image of luggage in airports, old photos. In medical images, the colorization is done for MRI brain images. As there this no existing work related to colorization of gray scale X-Ray images, this proposed work is not able to compare with the numerical results.

From the numerical results, with a sample image, the colored X-Ray image detection accuracy is measured as 69.0026 percent. But whereas, for the same sample image, the gray scale X-Ray image detection showed only 56.7928 percent. The same procedure is done for a set of sample images. In all the samples, the colored X-Ray images shows better accuracy than the ordinary gray scale X-Ray image. This proposed work, will help the Physicians in finding the severity of the infection better than the conventional gray scale X-Ray image.
10.2 Future Scope of the Work:

There are possibilities for the future improvement in this area of colorization of X-Ray images and detecting the severity of the Pneumonia infection. In this research two colorization algorithms are implemented. First with reference image alone and the second with chrominance checking. In the continuation of this proposed work, even better algorithms may be used for color conversion which decreases the computational and time complexities. In the second part of the work, Fuzzy C-Mean algorithm is used for ROI Segmentation. This algorithm may also be improved in the future work. Thus by refining with the colorization and segmentation algorithms, the final accuracy detection numerical results which is got for a specific sample discussed in chapter IX, can even be increased.

This Research work is carried out for the detection of severity of Pneumonia infection in chest X-Ray images. This can be further improved with other types of abnormal symptoms in chest X-Ray which includes, Collapsed lung, Collection of fluid around the lung, Lung cancer, Lung tumor, Malformation of the blood vessels, Scarring of lung tissue, Tuberculosis.