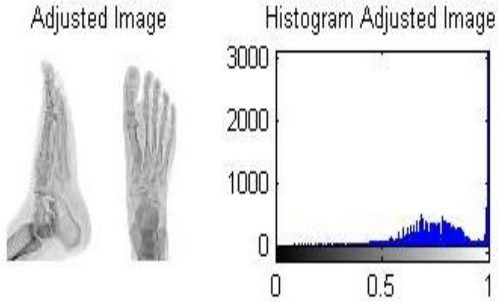

Figure 2: Shows bone scan image after adjustment filtering in MatLab

Using Image Processing Toolbox design and filters for image data was implemented.

Fspecial Filter

For linear filtering, MatLab provides the fspecial command to generate some predefined common 2D filters. h = fspecial (type) creates a two-dimensional filter h of the specified type. Fspecial returns h as a correlation kernel, which is the appropriate form to use with imfilter Fig.3.

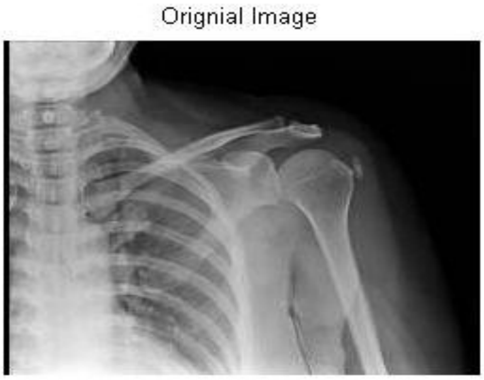

Figure 3: Shows original shoulder x-rays image

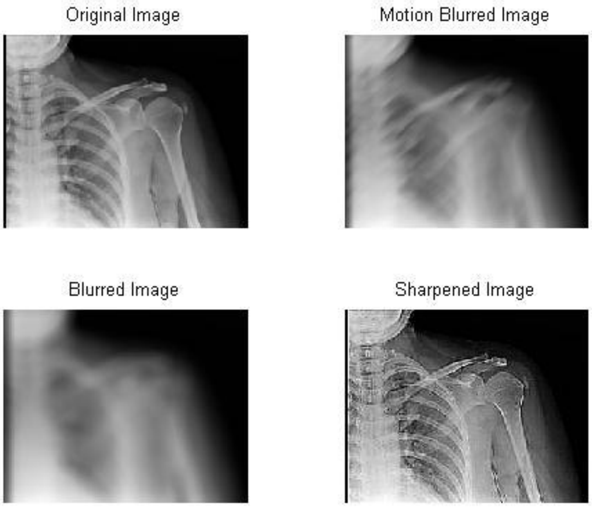

Figure 4: Shows Fspecial filter

Convolution kernel filter

Figure 5: Shows Original Image

Figure 6: Shows [3 3] fspecial filter of figure 3-5

Figure 7: Shows [9 9] fspecial filter of figure 3-5

Figure 8: Shows [25 25] fspecial filter of figure 3-5

Removal impulse noise from x-rays images

Figure 9: Impulse noise elimination by median filter. (a) Original image (b) the image with impulse noise (c) the image on which the noise is suppressed with the median filter. [(a) to (c) from left to right]

Removing Noise By Adaptive Filtering

The wiener2 function applies a Wiener filter (a type of linear filter) to an image adaptively, tailoring itself to the local image variance. Where the variance is large, wiener2 performs little smoothing. Where the variance is small, wiener2 performs more smoothing. This approach often produces better results than linear filtering. The adaptive filter is more selective than a comparable linear filter, preserving edges and other high-frequency parts of an image. In addition, there are no design tasks; the wiener2 function handles all preliminary computations and implements the filter for an input image. wiener2, however, does require more computation time than linear filtering. Wiener2 works best when the noise is constant-power ("white") additive noise, such as Gaussian noise.

The example below applies wiener2 to an image of Saturn that has had Gaussian noise added.

1) Read in an image. Because the image is a truecolor image, the example converts it to grayscale.
2) The example then add Gaussian noise to the image and then displays the image. Because the image is quite large, the figure only shows a portion of the image.

Figure 10: Portion of the Image with Added Gaussian Noise

3. Remove the noise, using the wiener2 function. Again, the figure only shows a portion of the image

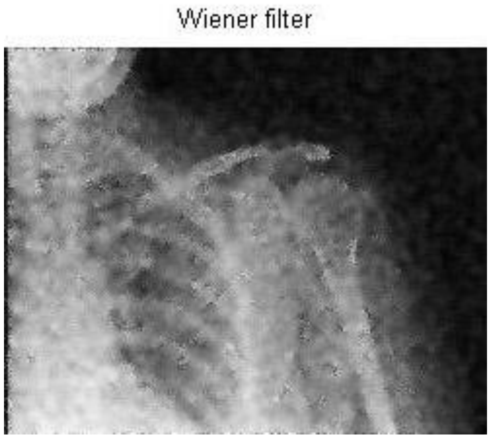

Figure 11: Shows Portion of the Image with Noise Removed by Wiener Filter

6. Conclusion

Advanced techniques of image processing and analysis find widespread use in medicine. In medical applications, image data are used to gather details regarding the process of patient imaging whether it is a disease process or a physiological process. Information provided by medical images has become a vital part of today's patient care. The images generated in medical applications are complex and vary notably from application to application. Nuclear medicine images show characteristic information about the physiological properties of the structures-organs. In order to have high quality medical images for reliable diagnosis, the processing of image is necessary. The scope of image processing and analysis applied to medical applications is to improve the quality of the acquired image and extract quantitative information from medical image data in an efficient and accurate way. This study conducted in College of Medical Radiological Science, Sudan University of Science and Technology and Elnileen Medical Center. The main objective of this study was to study the enhancement of SPECT images using filtering technique. In Nuclear Medicine, there are two main methods of patient imaging, the imaging with Planar Imaging, Dynamic Imaging or SPECT and the PET. During the last decade, hybrid systems have been developed integrating the CT technique with either SPECT or PET resulting in SPECT/CT and PET/CT respectively. The data analyzed by using MatLab program to enhance the contrast within the soft tissues, the gray levels in both enhanced and unenhanced images and noise variance. The main techniques of enhancement used in this study was For linear filtering, MatLab provides the fspecial command to generate some predefined common 2D filters. h = fspecial (type) creates a two-dimensional filter h of the specified type. fspecial returns h as a correlation kernel, which is the appropriate form to use with imfilter. The results of this technique agreed the results of Robiul et al, (2011), Nasrul et al, (2012), Gupta et al, (2012) and Smriti et al, (2012) who used non-linear filtering based methods to enhance the nuclear medicine images. The anther technique was Convolution kernel filter. Filtering is a technique for modifying or enhancing an image. For example, researchers can filter an image to emphasize certain features or remove other features. Image processing operations implemented with filtering include smoothing, sharpening, and edge enhancement. Filtering is a neighborhood operation, in which the value of any given pixel in the output image is determined by applying some algorithm to the values of the pixels in the neighborhood of the corresponding input pixel. A pixel's neighborhood is some set of pixels, defined by their locations relative to that pixel. Linear filtering is filtering in which the value of an output pixel is a linear combination of the values of the pixels in the input pixel's neighborhood. Luqman et al, (2011) stated in their study of enhancement of bone fracture image using filtering techniques that the Blind Deconvolution Algorithm is a better technique in reducing the speckle and noise without fully eliminating the image edges.

References

[1] Adam MJ, Wilbur DS (2005) Radiohalogens for imaging and therapy. Chem Soc Rev 34:153–63
[2] Adelson, E.H., Bergen, J.R. 1991. "The plenoptic function and the elements of early vision", In Computation Models of Visual Processing, M. Landyand J.A. Movshon, eds., MIT Press, Cambridge, 1991, pp. 3-20.
[3] Arvo, J., 1994, The Irradiance Jacobian for Partially Occluded Polyhedral Sources, Proc. ACM SIGGRAPH, ACM Press, pp. 335-342.
[4] Ball, J., Moore, A., 1997, Essential physics for radiographers, 3rd edition, Blackwell Scientific, Oxford.
[5] Ball, J., Price, T., 1995, Chesney's radiographic imaging, 6th edition, Blackwell Scientific, Oxford.
[6] Buehler, C., Bosse, M., McMillan, L., Gortler, S., Cohen, M., 2001, Unstructured Lumigraph rendering, Proc. ACM SIGGRAPH, ACM Press.
[7] Farr, R., Allisy-Roberts, P., 1997, Physics for medical imaging, W.B. Saunders, London.
[8] Fritsch D.S.; Chaney E.L.; McAuliffe M.J.; Raghavan S.; BoxwalaA.; Earnhart J.R.D., 1995,International Journal of Radiation Oncology, Biology, Physics, Volume 32, Number 971, , pp. 217-217.
[9] Georgiev, T., Zheng, C., Nayar, S., Curless, B., Salesin, D., Intwala, C., 2006, Spatio-angular Resolution Trade-offs in Integral Photography, Proc. EGSR .

Author Profile

Yousif Mohamed Yousif Abdallah received the B.S., M.Sc. and PhD degrees and M.Sc. in nuclear medicine and Radiotherapy Technology from College of Medical radiological Science, Sudan University of Science and Technology in 2005, 2009 and 2013, 2014, respectively. During 2006 up to date, he is staying in College of Medical radiological Science, Sudan University of Science and Technology. He is now assistant professor, college registrar and Consultant Radiation Therapist.

Rajab M. Ben Yousef received PhD in radiology. He is M.Sc. medical physics student. He is now working at Faculty of Medical Technology, Alzawya University, Alzawya, Libya