IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

IMAGE PRE-PROCESSING TECHNIQUES FOR X-RAY MEDICAL IMAGES: A SURVEY

[1]Shashikala H K, [2]Sindhu Madhuri G

[1] Assistant Professor, [2] Assistant Professor
Department of CS&E
Faculty of Engineering & Technology,
Jain (Deemed to be University)
Bangalore, India

Abstract: Medical imaging mainly concentrates on revealing the inner structures of the body which are covered by skin, muscles and bones. Medical image processing techniques are used for checking the inner structures details inside the human body for diagnosing, monitoring and for treating various types of diseases. Medical image processing is a very important task in health informatics field. Variety of techniques are used for processing the images which are captured using various methods like X-ray, Magnetic Resonance Imaging (MRI), Computed Tomography(CT), PET (Positron Emission Tomography) and ultrasound. In medical images lot of noise and irrelevant information will be present in the captured images. Various image pre-processing techniques are required to remove irrelevant information from the captured image and to improve the image quality. After performing image pre-processing techniques quality of the image will be improved. This paper presents a various image pre-processing techniques to eliminate the noise from an input image and to improve the quality of acquired images.

Index Terms **- Image Processing, Image Enhancement, Pre-processing, medical image, X-Ray.**

Introduction

Medical images are the fundamental part in medical field, these images helps in understanding the nature of human biological system and to diagnose the various diseases and for treatment [1]. The collected images from the various sources have to be pre-processed before the analyzation process. Various types of noises which are present in the captured images has to be eliminated and quality of image has to be enhanced before the segmentation and classification process. Various types of filters will be used for eliminating the noises in the captured image and different contrast enhancement methods are available to improve the quality of captured image [2]. X-Ray images will be used for observing the internal organs in the human body. During the process of taking X-Ray an X-ray beam will pass through the human body, and part of the energy of the X-Ray beam will get absorbed, this process is termed as attenuation [3]. X-Ray is the extensively used diagnostic tools in the medical field. X-Rays are used to find out various types of bone related issues like fractures, arthritis, osteoporosis and dental problems. The main drawback of X-Ray image is, its poor contrast and it contains various types of noises. Most prevalent noises present in the X-Ray images are: Poisson noise, speckle noise, Gaussian noise and salt and pepper noise. Poisson noise and Gaussian noises are considered as additive noises, and demising models have devised based on these noise models. The main cause for low quality and noise in the X-Ray images is because of more amount of fluid in the human body. Pre-processing techniques are performed on the X-Rays to enhance the contrast of the image. If image enhancement techniques are used before removing the noise then it will increase the noise and it could leads to loss of information in an image. So noise removal has to be performed using suitable filters. The Process of eliminating noise from the captured image is termed as denoising. Various filters are available to eliminate the irrelevant information from the captured images. Enhanced image after removing the irrelevant information from the image is used in variety of image processing application. Enhanced image is obtained after applying various filtering techniques and image enhancement techniques. The pixel intensity and an image quality is enhanced after the pre-processing step. After the pre-processing stage, the quality of an image will be improved [2].

I. LITERATURE SURVEY

As more number of applications are using digital image processing techniques within the medical field, the requirement for implementation of appropriate algorithms for processing the medical images for detection, Screening and treating various sorts of diseases has also increased. Medical images consists of noise, blurriness because of low contrast and this might lead to wrong diagnosis. Medical Imaging mainly concentrates on uncovering and revealing internal structures which are hidden by the skin, bones and muscles. It is used to analyse, diagnose, recognize and treat the various types of diseases.

Medical Images are used in majority of the applications such as Nuclear medicine, radiography, Ultrasound, Medical Resonance Imaging. Computed tomography. Low contrast and poor quality are the main issues faced in medical imaging. Image Enhancement process makes the image clear for the human perception or for machine analysis. In the processing of image enhancement, there will not be any change or improvement of the information that is available within the image. Mainly it will highlight only the important features which are available in the study like edge-feature, line-feature etc., for the detection of the objects in an accurate and efficient method [4].

In various medical images of X-Rays such as digital radiography (DR), computed radiography (CR), computed tomography (CT) and fluoroscopy. Images of these types are commonly applicable for better treatment of human diagnosis process. In medical field, our aim is to attain accurate and better results so we focus more on noise. Therefore, noise has to be removed from the captured images by considering the type of noises.

One of the important medical imaging technique used is radiography which highlights more on electromagnetic waves for monitoring the internal health conditions in the human body. The X-ray generator generates the heterogeneous beam of X-rays and after which they are projected on the object. The X-rays which penetrates through the object are captured by the detector and provides the superimposed 2D representation of the organs and the internal structures in the human body [5].

Figure 1: X-ray image of a chest

Figure 1 shows a typical X-ray image which provides details of the chest. Radiography is also used for dental examination and orthopedic evaluations etc. Radiography incorporates medical radiography and industrial radiography. If the examined object is living (either human or creature) then it is termed as medical radiography, and all other radiography is considered as an industrial radiography.

In medical image processing field one of the important step is enhancing of an captured image. There are various types of imaging methods that are available based on the variety of applications available currently. Researchers have identified various techniques for enhancing the captured image which are used to improve quality of the captured image [6].

II. IMAGE PRE-PROCESSING TECHNIQUES

In medical field, extensively used diagnostic tool is X-Ray. During image pre-processing step, various types of methods are applied on the input images in digital image processing applications. The raw images collected from the hospitals will not be appropriate for processing directly because various types of noises and unwanted information will be present in the chosen input images. So, the input images have to be preprocessed before analysis. Image Pre-processing is a necessary step in all the medical imaging applications for further processing like segmentation and classification [7]. The below figure 2 represents image pre-processing steps such as image conversion, image resize, noise removal and image enhancement methods to improve the contrast or the appearance of the image, to detect the minute details correctly [8].

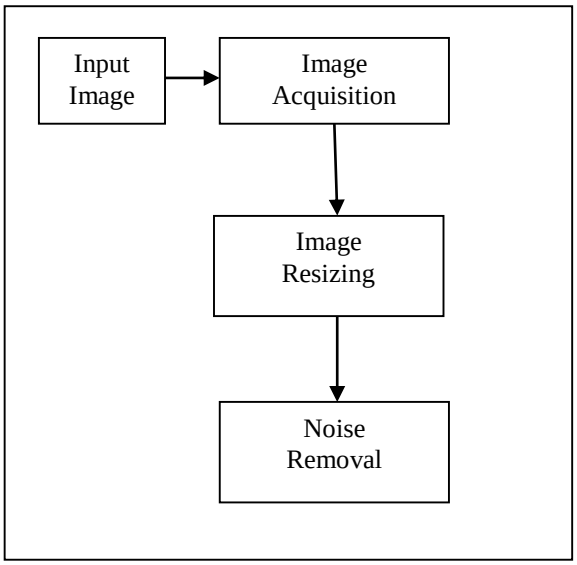

Figure 2: Block diagram

The below are the basic steps involved in the digital image pre-processing techniques:

- Image acquisition
- Image resizing
- Noise removal
- Image Enhancement

Image acquisition: It is a process of retrieving an image from various sources. Image acquisition is the initial step in all the medical image processing applications. An objective of an image acquisition step is to transform an optical image into array of numerical values which will be manipulated later in a computer system.

Image resizing: It is a necessary step in all the medical image processing applications, its objective is to increase or decrease the size of the given image in the pixel format based on the application. A precise resizing of an input image is a necessary step in most of the image processing applications, like face recognition, finger print recognition, security, and microscope imaging and so on.

Noise Removal: In this step unwanted and irrelevant information present in the captured image will be eliminated to improve the clarity of the image. Noise is introduced into the medical images by a various medical equipment's or different types of scanners during image acquisition stage. Noise in the chosen image is considered as an undesirable while capturing the image in the image acquisition phase. The presence of noise in the input image will have a spotted, coarse, textured, or a snowy look in an image. Various types of noise may exist in the input image and the most common types of noises found in medical images are Salt and pepper noise, Gaussian noise, Shot or Poisson noise and Speckle noise.

Noise elimination will be carried out either in spatial domain or in the frequency domain. In many of the medical imaging applications elimination of noise is performed in frequency domain. For the fundus images noise elimination in spatial domain will be appropriate. Since fundus images requires sharp edge detection and the non-linear filtering techniques. Non-linear filtering techniques requires more processing time, but it provides a better result than the linear filtering techniques, and also it will preserve image information. So spatial non-linear filtering methods such as mean filter, wiener filter, Gaussian filter, median filter can be applied for fundus images to eliminate the noise and to preserve the edges [9].

Image Enhancement: enhancement of the image is a very significant step in the image processing applications. Compared to all other tasks, this step is very important as well as complex task. Image enhancement methods are performed for improving the appearance of the input images. Image enhancement technique is as a process of enhancing the clarity of an image. This step produces enhanced image which is more appropriate for the specific application than the original image.

Image enhancement methods are classified into two broad types: spatial domain image enhancement techniques and frequency domain image enhancement techniques. In Spatial Domain techniques manipulation operation is performed on the distinct pixels of an input image. This technique also includes point arithmetic operations and the neighborhood enhancement methods. The Frequency domain techniques computes the Fourier transform of an image and then output will be multiplied by the filter, finally we take the Inverse Fourier transform to get the enhanced image. The frequency domain methods includes low-pass filtering, high-pass filtering and homomorphic filtering techniques.

In filtering techniques, filters are primarily used in an input image to either suppress the high frequencies in an image which is termed as smoothing the image, or the low frequencies which is termed as enhancing or detecting edges in the image [10]. Various methods exists and the optimal choice depends upon the chosen image and the application. Image filtering is suitable for most of the applications such as smoothing, sharpening, noise elimination, and edge detection.

IV CONCLUSION

Medical image processing is a very important task in the field of medicine. In this paper we highlight mostly on the image pre-processing techniques on medical X-Ray images, which are very important and fundamental step in the applications of medical imaging. Variety of noise removal and image enhancement methods used for the medical imaging techniques are discussed. As there are various types of images, the captured image differs in the quality, brightness, noise and contrast based on the tool that is being used. X-ray images requires noise removal and image enhancement techniques and fundus images requires only image enhancement techniques since it uses highly specialized photographic techniques. This paper provides a clear idea of image pre-processing techniques for further processing to analyze, detect or to treat diseases.

V ACKNOWLEDGEMENT

We authors submit sincere thanks to the Hon'ble Chairman, Chancellor, Vice-Chancellor, Registrar, Director and all staff members of the CSE department, School of Engineering & Technology, Jain University for their high motivation, support and encouragement in all respects for publishing this paper.

REFERENCES

[1] [1] Shaik Naseera1, G.K. Rajini, B. Venkateswarlu, Jasmin Pemeena Priyadarisini M, A Review on Image Processing Applications in Medical Field, Research J. Pharm. and Tech August 2017; 10(10):3556-3560. (0974-3618).

[2] S.Perumal1 and T.Velmurugan, "Preprocessing by Contrast Enhancement Techniques for Medical Images," Volume 118 No. 18 2018 International Journal of Pure and Applied Mathematics, ISSN: 1311-8080.

[3] S. Hosseinian, H. Arefi, "Assessment Of Restoration Methods Of X-Ray Images With Emphasis on Medical Photogrammetric Usage", The International Archives of the Photogrammetric, Remote Sensing and Spatial Information Sciences, 2016, XXIII ISPRS Congress, 12–19 July 2016.

[4] P. Vasuki, J.Kanimozhi, M.Balkis Devi, "A Survey on Image Preprocessing Techniques for Diverse Fields of Medical Imagery", International Conference on Electrical, Instrumentation and Communication Engineering (ICEICE2017).

[5] R. Beaulah Jeyavathana, Dr. R.Balasubramanian, A. Anbarasa Pandian, "A Survey: Analysis on Pre-processing and Segmentation Techniques for Medical Images", International Journal of Research and Scientific Innovation (IJRSI) | Volume III, Issue VI, June 2016 | ISSN 2321–2705.

[6] Dr.K.Murugan, Mr.Finney Daniel, Mr.T. Shanmugaraja,Mr.T.Venkatesh, Mr. K.Siddarthraju, Mrs. Dhivya Devi, Ms.M.Supriya, "A critical review on medical image processing techniques". Journal of Critical Reviews, Vol 7, Issue 5, 2020, ISSN- 2394-5125.

[7] Shaik Naseera. Client Server Architecture for Embedding Patient Information on X-Ray Images. Research J. Pharm. and Tech 2016; 9(9):1337-1340.

[8] Maitra, IndraKanta, Sanjay Nag, and Samir K. Bandyopadhyay. "Accurate breast contour detection algorithms in digital MRI". International Journal of Computer Applications, Vol.25(5), pp: 1-13,2011.

[9] Li, Qiang, and JinghuaiGao. "Contourlet based seismic reflection data non-local noise suppression". Journal of Applied Geophysics, vol. 95. pp : 16-22,2013.

[10] Lysaker, Marius, ArvidLundervold, and Xue-Cheng Tai. "Noise removal using fourth-order partial differential equation with applications to medical magnetic resonance images in space and time." IEEE Transactions on image processing, Vol.12(12), pp: 1579-1590,2003.