

Analysis of X-Ray Images with Image Processing Techniques: A Review

Vikas Kajla,

Department of Biomedical Engineering,
GJUS&T, Hisar, Haryana, India
aneel_khatak@yahoo.co.in

Anju Gupta,

Department of Biomedical Engineering,
GJUS&T, Hisar, Haryana, India

Anil Khatak,

Department of Biomedical Engineering,
GJUS&T, Hisar, Haryana, India

Abstract— Human body suffers from various problems it consists of different parts such as legs, hands, bones, bones get cracked or discontinuity most of the times due to pressure applied on it which may be due to the accident, sports while playing etc. Osteoporosis is one of the major problems occurs due to extra use of bones radiologist suggests the patients take x-ray images of the bones for diagnosis purpose. This study is a tutorial review on medical imaging processing and repository techniques appeared in the literature. Many times, it is difficult and time-consuming to find out the location of fracture in the patient who is suffering from pain. Today medical imaging technique played the significant role in research and diagnosis field. X-ray imaging technique is used to diagnose and also used to represent anatomical structures such as bones, in human beings. This paper is a tutorial review of X-ray imaging technique which is used to detect bone fractures and then the obtained image is processed by different image processing methods such as Computer Aided Diagnosis, Edge Detection, segmentation which are beneficial for technicians.

Keywords—X-Ray Imaging, Bones, Image Processing, Image Analysis

I. INTRODUCTION

Wilhelm Roentgen discovered the existence of X-rays in 1895. X-Rays is an electromagnetic radiation. The wavelength of X-ray ranges 0.01 To 10 Nm where its frequency lies between 30 Petahertz and 30 Exahertz [1][2]. The energy range of X-ray is from 100 Ev and 100 Kev. Wave Length of X-ray is shorter than UV Rays but Longer than Gamma Rays. X-ray is mostly used in Hospitals to produce Images of Bones which can be checked for any breakage or discontinuity of Bones. Some properties of X-ray like they can penetrate less dense matter such as skin and body Tissue, but it cannot penetrate bones [3][4][5].

Bones are the solid organs in the human body that protect many important organs such as heart, lungs etc. The human body consists of 206 bones with various

shapes, structures, and shape [6]. Different types of bones are flat, long, short, irregular and sesamoid. The

femur bone is the largest bone in the body whereas the auditory ossicles are the smallest bone. fracture in bone is the common problem. Fracture is a medical condition when there is a discontinuity in the continuity of the bones. Different types of fractures such as transverse fractures, open fractures, simple fractures, spiral fractures, commuted fractures etc [5][6]. Long bones may suffer from different types of fractures like greenstick-when one side of the bone breaks while the other gets bent, spiral-bone gets twisted, commuted - bone gets crushed, transverse. Fractures can be detected by X-ray [7]. Image processing is a powerful tool to modify enhance and detect any particular image details with high accuracy therefore 2d medical imaging research are increasingly dependent on computer-aided diagnosis (cad) where the missing details of visual inspection can be effectively avoided using automated segmentation medical images and various images algorithms to make CAD and image processing the most useful tool for the radiologist. It's potential to draw attention to the finding of the images, highlighting changes from previous images or quantifying the size, shape, and textures of the feature's CAD has its potential to be a useful tool for the radiologist, by drawing [7][8][9]. Some CAD systems are used for image registration, virtual interaction, visualization, simulation or training. Presently CAD is used in the identification of clustered microcalcifications and masses in breast tissue. This system call attention to the possible abnormalities is as good as or better than analyzing by the second radiologist [9][10][11]. They suggest that this type of aid can be helpful in reducing the variability in detecting the abnormalities.

Furthermore, the article is arranged as follows. The related articles are briefly explained in section 2. Sections 3 various techniques are compared through complexities & accuracy then conclusion & references in the end.

II. RELATED WORK

Yuan et.al: This paper deals with the aim of present research in which technology which requires computerized image processing, image analysis, and pattern recognition. This provides the image processing

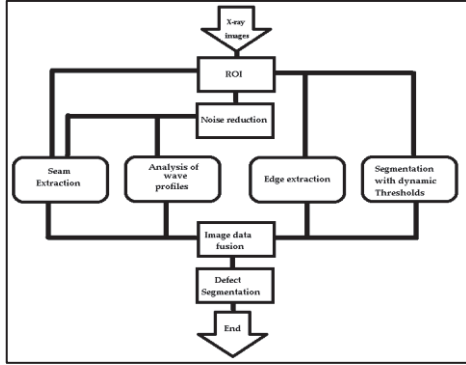


Figure 1: Proposed algorithm

method for automatic defect detection using image data fusion that provides with several methods which include extraction of the edges of the images, wave profile analysis, image segmentation with the dynamic threshold. Figure 1 shows the block diagram of the proposed algorithm. This paper describes the defect that induces an abrupt change over a predefined extent of the image intensity can be segmented regardless of the number, location, shape, or size. Therefore, this proposed method is better and practical [12].

Lugman et.al: This paper uses the Ultrasound imaging that is used to make changes in the images which are unclear for fast interpretation .to enhance the ultrasound images of long bone fractures. This contains image contrast enhancement and reduction using these filter techniques such as Wiener, Average and Median Filters. This paper gives a huge improvement obtained from these filter techniques that can be seen through visual inspection and histogram analysis the Wiener Filtering is the best technique among all three in this technique reducing the speckle without eliminating the image edges [13].

Jacob et.al: This paper uses the techniques which are used for detection of bone fracture that has been applied to obtained images from different variation like X-ray, CT, MRI and ultrasound field of medical imaging has been modifying not only in the acquisition of medical images but also in the technique of interpretation. This research is used to interpret and to diagnose ailment from medical images with less aid from experts. This technique uses the methods involved in designing CAD systems for bone fracture detection [14].

Mahmoud et.al: Computer-aided diagnosis is getting popular among medical practitioners and researchers. It provides very accurately, time& efforts saving, and less expensive diagnosis which used in the medical imaging profession. The main advantage of computer-aided diagnosis that it reduces errors. Long bones fractures can be detected using the X-ray imaging technique. In this paper with the addition to the detection of long bone fractures, the author also determines the fracture type. Author extracted the different characteristics after pre-processing of the image and then the extracted characteristics are used, and the algorithm is designed for the detection of fracture. The final output of this research work is correct and efficient [15].

Anu et.al: This paper deals with the study of Detection of Bone Fracture using Image Processing Methods, used images of the fractured bone was obtained and various processing techniques like segmentation, edge detection etc methods were adopted. Here we detect the bone fracture by using image processing technique such as image segmentation method, the edge detection method, etc. are adopted by the author. The images are converted to greyscale images and then the images are filtered to remove the noise for a better quality of the image. The variations in images result is based upon colour, intensity, pixels, etc. which for image processing for the selection and extraction of image characteristics. These characteristics are used to classify between fractured bone and non-fractured bone. The system proposed is accurate, sensitive and is very specific in terms of performance [16].

Kaur et.al: This paper tells that Fracture occurs in any type of bone in our body like wrist, ankle, hip, rib, leg,

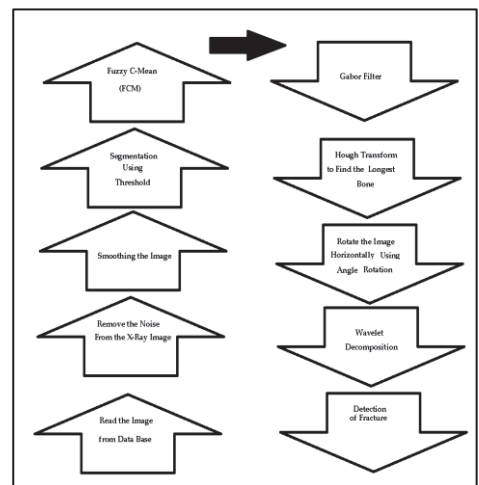


Figure 2. Block diagram of algorithm.

chest. Fractures of bones at different body parts such as ribs, legs, ankle, hip etc. Figure 2 depicts the block diagram of the proposed algorithm. Are detected with the help of x-ray imaging technique by using image segmentation and an algorithm is proposed for the detection of bone fractures. Then the fracture location is selected by the technician manually so that the results are with fewer drawbacks [17].

Gajjar *et.al*: Diagnosing The image processing technique particularly MATLAB is being used in the area of image processing for the detection of fractures in the bones and also so many applications are developed for the bone fracture detection. Figure 3 describes the

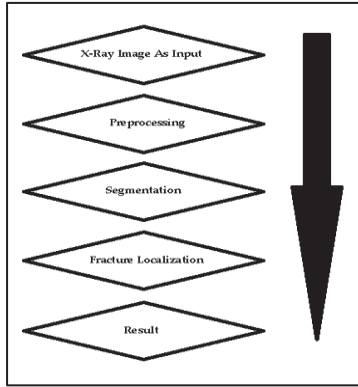


Figure 3. Block diagram of algorithm.

block diagram of the proposed algorithm. According to this research work the exact position of bone fracture i.e. the place where the bone fracture is located and it also detects the discontinuity/crack even in cartilages. [18]

Wadker *et.al*: Diagnosing technique for the fractures in public areas are discussed in this paper. Regularized

Level Set Evolution (DRLSE) segmentation method and the canny edge detection method are the two techniques which are used for the detection of fracture in pubic ring area. Grey Level Co-occurrence Matrix (GLCM) examination technique for the displacement for pubic bone has been done and the output is having positive results and it will help the medical practitioners and technicians for good quality check-up of the patient.

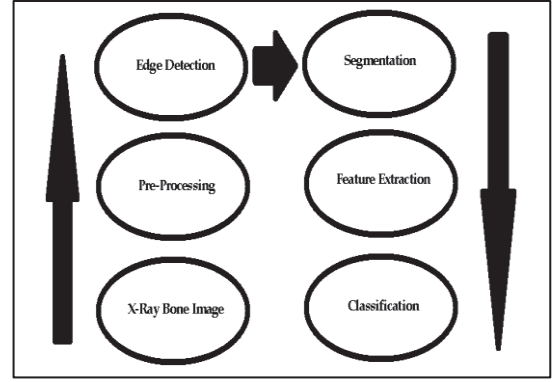


Figure 4. Block diagram of algorithm.

Figure 4 illustrates the block diagram of the proposed algorithm [19].

III. COMPARISON

Table 1 details the brief comparison of the X-ray techniques that are employed X-ray image processing systems. The complexity of the design system is judged based on no of stages involved.

	Techniques	Complexity	Accuracy	Applications
Yuan et.al (2006) [12]	Automatic Defect Detection in X-Ray Images Using Image Data Fusion	High	Medium	X-RAY detection for minute defects
Luqmanet.al (2015) [13]	Enhancement of Bone Fracture Image Using Filtering Techniques	Medium	94	Ultrasound
Jacob et.al (2009) [14]	Survey of Bone Fracture Detection Techniques	Medium	Medium	Ease of interpretation in Ultrasound, MRI, x-ray, CT- scan
Mahmoud et.al (2013) [15]	Determining the Type of Long Bone Fractures in X-Ray Images	Medium	High	Detection using x-ray images
Anu et. al (2015) [16]	Detection of Bone Fracture using Image Processing Methods	High	85	Medical,
Kaur et.al (2016) [17]	Bone Fraction Detection using Image Segmentation	High	Medium	Small fractures detection
Gajjaet.al (2017) [18]	pubic bone fracture and displacement detection using x-ray images	Less	Medium	Remote sensing
Wadkeret.al (2015) [19]	Fracture detection in X-ray images of long bone	Medium	High	Image restorations, medical

IV.CONCLUSIONS

X-ray imaging technique has many applications like detection of fracture, metal, etc. Extensive and effective research has been already done and also there a lot of space for further study in this field of the medical industry. Many imaging techniques have been studied in this article such as Computed Aided Diagnosis, Image segmentation, Edge Detection, etc. Such parameters ultimately define the applicability of the techniques in image processing. The main objective behind this study is to give more accurate, effective and less time-consuming technique for recognizing bone fractures in the body. Further enhancing this study, we give more ease to the practitioners and make the technique more efficient and productive.

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