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EXTRACTING BONE STRUCTURES FROM X-RAY IMAGES THROUGH LINE FLECTION ANALYSIS

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Abstract

Segmenting X-ray bone images poses a significant challenge in medical applications like osteoporosis detection and bone fracture identification. The varying brightness across the image complicates the differentiation between bones, soft tissue, and background. Existing segmentation methods, both customized and standard (like active contour and region growing), have been applied to bone X-ray images. However, due to the diverse nature of bone structures and lighting conditions, none of these methods offer comprehensive solutions. In this paper, we introduce a novel bone segmentation method involving preprocessing steps like noise reduction and edge detection. By analyzing intensity fluctuations across all rows of the image, our approach achieves more precise segmentation of bone regions. Visual assessments demonstrate that our proposed algorithm outperforms conventional methods and even some recent approaches in segmenting bones effectively.

KEYWORDS: X-ray bone segmentation, Medical x-ray images, Contour extraction, Image processing, edge detection.

1. INTRODUCTION:

New medical technologies are equipped with more productive sensors which can generate higher image qualities with different modalities. One of the most popular medical image modality is X-ray imaging that is utilized in many medical applications such as diagnosing of bone fractures and degeneration, infections, and tumors. Today, medical imaging can be a branch of science that is reaching great heights in the healthcare industry thanks to technological advances and advancements in computer code. It plays an important role in defining diseases and treating patients, and helps doctors make choices about the type of treatment. Due to the many health problems in the fashionable society, it has become necessary to treat and detect fractures in many different age groups. It is also a typical deficiency in many already developed countries, where fractional varieties also increase cutting. Bone fractures can occur due to a minor intervention or due to some disease. Therefore, quick and correct naming is important when prescribing each treatment. Next, radiologists and doctors take X-rays to determine if a fracture has occurred and the exact type of fracture. Therefore, quick and correct naming is important when prescribing each treatment. Next, radiologists and doctors take X-rays to determine if a fracture has occurred and the exact type of fracture. The feature extraction process used a method called the Hough transform to detect lines. the development of a related cost effective imaging system for rapid and accurate classification of fractures supported by information from photographs/CT images. Various image processing techniques such as extraction modes, segmentation, preprocessing and edge detection are used in this study. Such techniques are classified as broken or intact bone when comparing the accuracy of different programming modes. They describe the accuracy of the fracture detection system to one eighth of its effectiveness and limitations We start from a gray scale image and smooth it by applying an edge preserving filter called guided filter. Then, we use multilevel canny edge detector to estimate the edges. Before finding the local maxima we rotate the original image to make it almost vertical. Therefore, we can effectively search for the peaks in intensity even in a horizontal long bone image by processing the image rows. Especially, the edges of long bones have the highest intensity in the X-ray images under test. Therefore, the local maximum of the intensity is a good estimation of a bone edge. Our proposed algorithm finds many local maxima (peaks) inside bone region and we use the result of canny edge detection as a guidance to select only proper peaks nearest to bone edges.

2. LITERATURE SURVEY

Stolojescu et al. used a clustering method and segmented the image using similarity parameters such as texture and intensity [4]. They finally distinguished the regions using an interactive method. In [5], it is assumed that there is no background and based on this assumption a fuzzy method is proposed to segment the bones. All aforementioned methods have a drawback that they cannot distinguish bone from muscle in some images, especially when the image quality is low or when the bone doesn’t have considerable intensity in comparison to muscle and background because of their density. In other words, these methods operate well on images with proper brightness and high contrast that the separated part has proper sharpness but not on low contrast X-ray images.

[6] proposed a method based on entropy and multilevel LOCO morphologic filter to separate the bone and adjust the result to contour shape. They also used snake model to improve the edge and find a narrow border

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Mahendran [2] used wavelet and morphology operations to determine region of interest in bone images. Sharma and Singh first removed the noise and improved the contrast and then extracted the bone using a proper threshold selected empirically [3]. Stolojescu et al. used a clustering method and segmented the image using similarity parameters such as texture and intensity

3.EXISTING SYSTEM

Inspection and interpretation of images obtained from X-rays, MRI or CAT scans, analysis of cell images. In medical applications, one is concerned with processing of chest X-rays projection images of trans axial tomography and other medical images that occur in radiology, nuclear magnetic resonance (NMR) and ultrasonic scanning. These images may be used for patient screening and monitoring or for detection of tumors' or other disease in patients.

X-rays and CT are most frequently used in fracture diagnosis because it is the fastest and easiest way for the doctors to study the injuries of bones and joints. Doctors usually uses x-ray images to determine whether a fracture exists, and the location of the fracture.

The Sobel filter is used for edge detection. It works by calculating the gradient of image intensity at each pixel within the image. It finds the direction of the largest increase from light to dark and the rate of change in that direction

3.1 SOBEL EDGE DETECTION OPERATOR:

In case of Sobel Edge Detection there are two masks, one mask identifies the horizontal corner and the other mask identifies the vertical corner. The mask which finds the horizontal corner that is equivalent to having the gradient in vertical direction and the mask which computes the vertical corner is equivalent to taking in the gradient in horizontal direction. Sobel masks are given in the figure 1.

-1	-2	-1
0	0	0
1	2	1

1	0	-1
2	0	-2
1	0	-1

Table 3.1: Sobel operators

By passing these two masks over the intensity image the gradient along x direction (Gx) and gradient along the y direction (Gy) can be computed at the different location in the image. Now the strength and the direction of the edge at that particular location can be computed by using the gradients Gx and Gy. The gradient of an image $(x,)$ at location(x,y) is defined as the vector

$$\nabla f = \begin{bmatrix} G_x \\ G_y \end{bmatrix} = \begin{bmatrix} \frac{\partial f}{\partial x} \\ \frac{\partial f}{\partial y} \end{bmatrix}$$

3.2 Sobel Filter Analysis:

Filtering is the process of applying masks to images and the application of a mask to an input image produces an output image of the same size as the input image. There are three steps of convolution are given which is necessary for filtering.

Step1. For each pixel in the input image, the mask is conceptually placed lying on that pixel.

Step2. The values of each input image pixel under the mask are multiplied by the value of the corresponding mask weights.

Step3. The result are summed together to yield a single output value that is placed in the output image at the location of pixel being processed on the input.

The pixel values of an original image is shown in the table 3.1 and Sobel masks are also shown in figure 1 for horizontal and vertical scan. Now compute Gx and Gy, gradients of the image performing the convolution of Sobel kernels with the image and use zero-padding to extend the image. Where Gx is the partial derivative of f along x direction and Gy is the partial derivative of f along the y direction. Computation of the magnitude of the gradient involves squaring the two components Gx and Gy adding them and takes the square root of this addition.

$$\nabla f = mag(\nabla f) = [G_x^2 + G_y^2]^{1/2}$$

This is because in sobel operator we have allotted more weight to the pixel intensities around the edge

Draw backs:

- It can be doesn't identify the exact corners
- Localization is reduce

4. PROPOSED SYSTEM

The X-ray/CT images are obtained from the hospital that contains normal as well as fractured bones images. In the first step, applying preprocessing techniques such as RGB to grayscale conversion and enhance them by using filtering algorithm to remove the noise from the image. Then it detects the edges in images using edge detection methods and segmented the image.

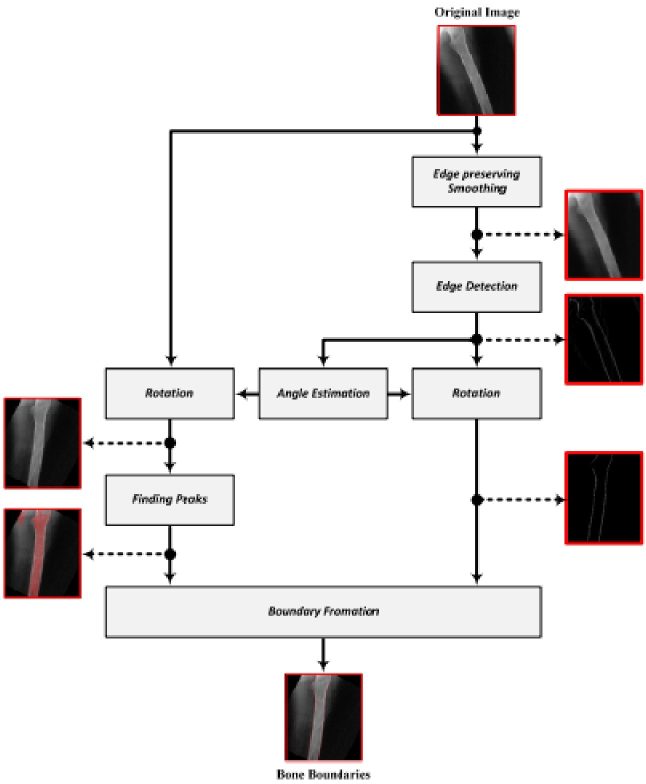

Fig 4.1 . Diagram of our proposed method

The Canny edge detector is an edge detection operator that uses a multi-stage algorithm to detect a wide range of edges in images. Canny also produced a computational theory of edge detection explaining why the technique works. Apply Canny Edge Detection: Use the edge function in MATLAB to apply the Canny edge detection algorithm. Apply Canny Edge Detection: Use the Convolve image f(r, c) with a Gaussian function to get smooth image f^(r, c).

$$f\hat{}(r, c) = f(r,c)*G(r,c,6)$$

• Apply first difference gradient operator to compute edge strength then edge magnitude and direction are obtained as before.

• Apply non-maximal or critical suppression to the gradient magnitude.

• Apply threshold to the non-maximal suppression image.

Unlike Roberts and Sobel, the Canny operation is not very susceptible to noise. If the Canny detector worked well it would be superior edge function in MATLAB to apply the Canny edge detection algorithm

Gradient Calculation: Compute the gradient of the smoothed image to find the strength and direction of edges. This is typically done using techniques like Sobel or Prewitt operators. Non-Maximum Suppression: Suppress non-maximum pixels, which help to thin the edges by keeping only the local maxima in the gradient magnitude. Edge Tracking by Hysteresis: Apply edge tracking by using two thresholds, a high threshold and a low threshold. Pixels with gradient magnitudes above the high threshold are considered strong edges, and those between the high and low thresholds are considered potential edges. Edge pixels are connected if they form a continuous path above the high threshold. a second order derivative defined as

$$\nabla^2 f = \frac{\partial^2 f}{\partial x^2} + \frac{\partial^2 f}{\partial y^2}$$

It has two effects, it will smooth the image and it computes the Laplacian, which yields a double edge image. Locating edges then consists of finding the zero crossings between the double edges. The digital implementation of the Laplacian function is usually made through the mask below,

0	-1	0
-1	4	-1
0	-1	0

G_x

-1	-1	-1
-1	8	-1
-1	-1	-1

G_y

The Laplacian is generally used to found whether a pixel is on the dark or light side of an edge. Apply high and low thresholds to determine strong and weak edges:

- If G(x, y) > High_Threshold, it's a strong edge pixel.
- If Low_Threshold < G(x, y) < High_Threshold, it's a weak edge pixel.
- If G(x, y) < Low_Threshold, it's not considered an edge pixel These equations are used iteratively across the entire image to detect edges.

5. RESULTS

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This approach proposed the algorithm for automatic detection of fracture in femur bone so as to facilitate more accurate and broad classification. This work is done using explicit coding in MATLAB. Initially, the X-ray image is stored in RGB, so conversion is done to grayscale prior to image preprocessing stage. The collection of X-ray images is taken from radiograph film resolution shown in fig 7.1 which also taken as training data for classification. This approach is developed for detection of fracture in femur bone using modified version sobel edge detection shown in fig 7.2 and result is compared with other edge detection techniques to process the image and the sobel edge detection is used as an approach to get clear edge of the bone to process the image and the canny edge detection is shown in fig 7.3 used as an approach to get clear edge of the bone

Fig 5.1: Browse The Input X-Ray Image

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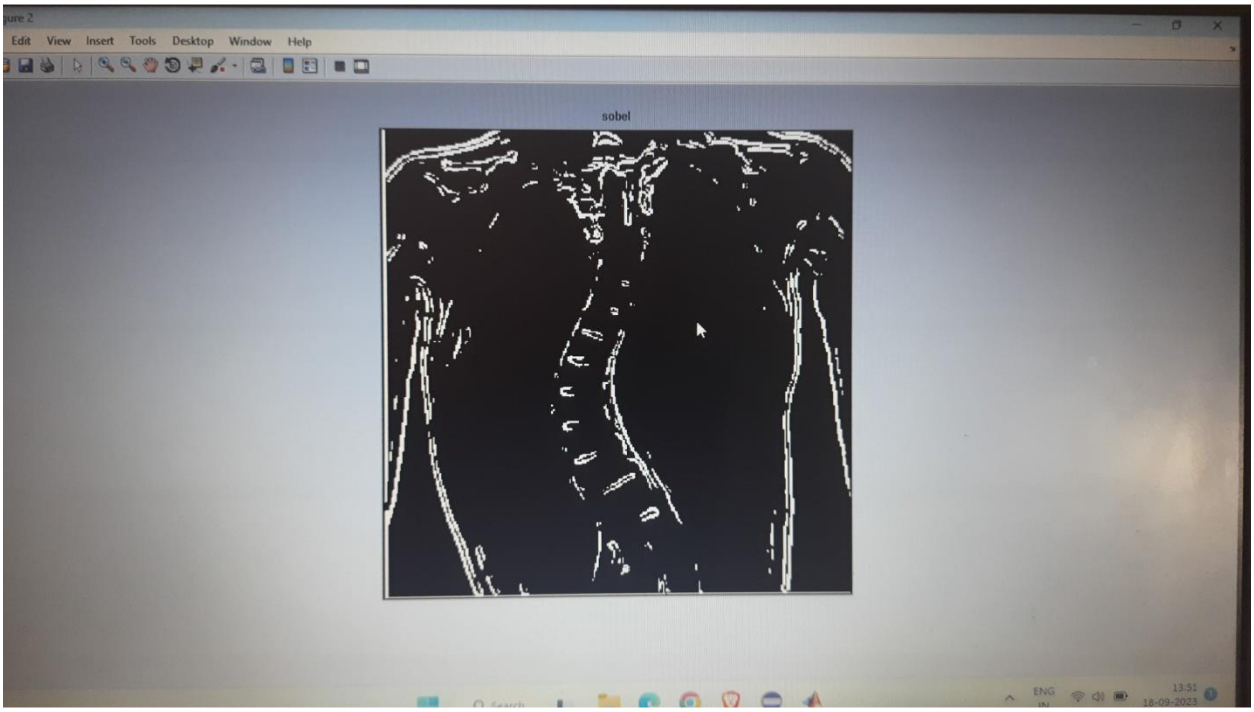

Fig 5.2 : sobel edge detection used in processed X-ray image.

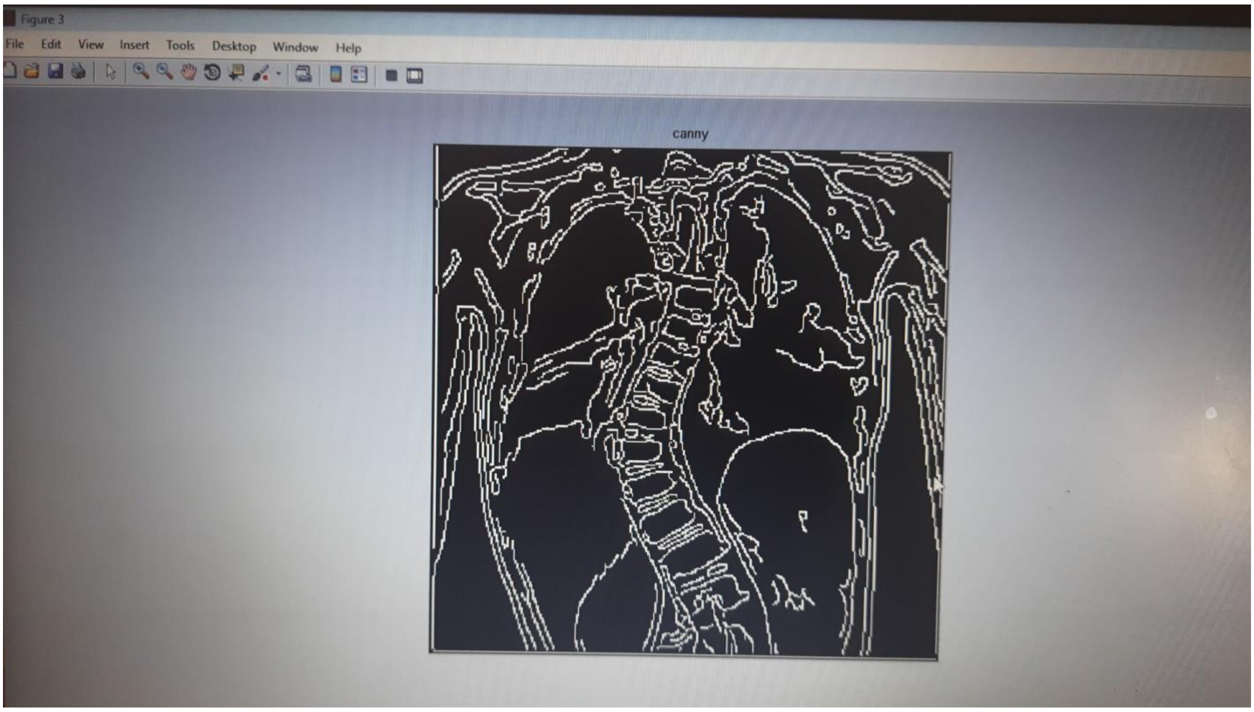

Fig 5.3: Canny edge detection used in processed X-ray image.

6. CONCLUSION

We presented a novel method for segmentation of bone X-ray images. Our method first smoothes the original gray scale image using an edge preserving filter and detects the edges.

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We observed that near the boundary of bone the intensity values are higher than those in the middle of bone. Therefore, we search along each row of image to find the local maxima in intensity and preserve only those edges that are nearest to the peaks.

REFERENCE

[1] C. Stolojescu-Crisan, S. Holban, "A Comparison of X-ray Image Segmentation Techniques," Advances in electrical and computer engineering, vol. 13, no. 3, pp.85-92, 2013.

[2] S. K. Mahendran, S. S. Baboo, "Enhanced automatic X-ray bone image segmentation using wavelets and morphological operators," International Conference on Information and Electronics Engineering, pp. 125-129, 2011.

[3] P. Sharma, J. M. Singh, "A Novel Approach towards X-ray Bone Image Segmentation using Discrete Step Algorithm," International Journal of Emerging Trends & Technology in Computer Science, vol. 2, no.5, pp. 191-195, 2013.

[4] C. Stolojescu-Crisan, S. Holban, "An Interactive X-ray Image Segmentation Technique for Bone Extraction," International Work-Conference on Bioinformatics and Biomedical Engineering, pp. 1164-1171, 2014.

[5] M. A. Ali, L. S. Dooley, G. C. Karmakar, "Object based image segmentation using fuzzy clustering," IEEE International Conference on Acoustics, Speech and Signal Processing, vol. 2, pp. 1-4, 2006.

[6] O. Bandyopadhyay, B. Chanda, B. B. Bhattacharya, "Entropybased automatic segmentation of bones in digital X-ray images," In Pattern Recognition and Machine Intelligence, pp. 122-129, 2011.

[7] O. Bandyopadhyay, A. Biswas,B. Chanda, B. B. Bhattacharya, "Bone contour tracing in digital X-ray images based on adaptive thresholding," Pattern Recognition and Machine Intelligence vol. 852, pp. 465-473, 2013.

[8] K. He, J. Sun, X. Tang, "Guided image filtering," IEEE Transactions on Pattern Analysis and Machine Intelligence, vol. 35, no.6, pp. 1397-1409, 2013.

[9] A. Hernández-Vela, C. Gatta, S. Escalera, L. Igual, V. MartinYuste, M. Sabaté, P. Radeva, "Accurate Coronary Centerline Extraction, Caliber Estimation, and Catheter

Detection in Angiographies," IEEE Transactions on Information Technology in Biomedicine, vol. 16, no. 6, pp. 1332-1340, 2012.

[10] C. Tomasi, R. Manduchi, "Bilateral filtering for gray and color images," IEEE Conference on Computer Vision, 839-846 1998.

[11] N. Otsu, "A Threshold Selection Method from Gray-Level Histograms," IEEE Transactions on Systems , Man, and Cybernetics, vol. 9, no. 1, pp. 62-66, 1979.

[12] Uniformed Services University of the Health Sciences, http://rad.usuhs.edu/

[13] X- ray Fracture Shaft Femur, www.boneandspine.com/xrayfracture-shaft-femur/