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AUTOMATIC DETECTION OF RADIUS OF BONE FRACTURE

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Abstract *-Automatic detection of radius of bone fracture in a x-ray image is considered as major process in image analysis by doctors and as well as radiologist now days, with increasing fracture rate due to vehicle accidents, age related issues and over physical activity by human beings. This paper proposed an algorithm for automatic detection of radius of bone fracture in all bones of the human body. The proposed system involves major steps, which includes image preprocessing, segmentation, feature extraction and radius of bone fracture detection. By the use of Hough transform radius of bone fracture is obtained. HT method shows the clear efficient and accurate results. MATLAB 2013 programming tool is used for the execution of the project.*

Keywords- X-ray, Medical images, segmentation, Hough transform.

I.INTRODUCTION

Fracture can be defined as a condition of breakage or lack of bone continuity. The bone is composed of cells, proteins, fibers, calcium and mineral salts. The number of bones joins makes the skeleton; It supports body shape and also protects the body's internal organs. With the help of the bones, the person can move, jump, swim, jump etc. Doctors cannot see fracture to naked eyes, consequently, imaging methods such as magnetic resonance, x-ray, CT are available, that helps the doctor to make a decision, the elaborate image gives a clear picture of the damage and doctors get quality information on the condition of the bone and the benefits of the patient medical field image has become a big tree. The use of the advanced image processing feature of the advanced algorithm that helps automatic beam detection fractured develops. The algorithm includes various image processing techniques for transformed output that helps professionals, automated radiologic diagnostic imaging. Radiologists often encounter x-ray image difficulty reading due to lack of lighting, fractures of noise rarely seen with naked eye, or being acquired. Digital image processing has become important in the areas of communication, biomedical, remote object sensing, industries, automation, robotic technology, aerospace study and education system. Medical imaging is a new field which includes image enhancement, visualization process, and detection of edge. Developing the system can help the radiologist to detect the abnormality of bone in X-ray imaging and will be effective in detecting the radius of the bone fracture.

The main aim of this research work is to automatically detection of radius of fracture of all bones of the body using the x-ray images.

2. LITERATURE SURVEY

The past and recent technique related to this work is discussed in this section. The main aim is to give details about the selected project and research of previously existed similar problem and result done by others and the methods going to apply in the selected project.

[1]. S P. Chokkalingam & K. Komathy proposed the method to know the presence of rheumatoid arthritis using image processing methods. For finding the GLCM features are Mean, Median, Energy, Correlation, mineral density of bone. After finding all features, it can be stored in the database. The dataset is trained within flamed and non-inflamed values and with the help of neural network.

[2].Snehal Deshmukh, proposed that canny edge detection can be used for finding the fractured bones from x-ray images and a conclusion made that performance, accuracy of the detection method is affected by its quality of the image.

[3].R. Aishwariya The proposed technique for the canny edge detector in the x-ray image locates the edges and using detection of boundary, in turn system detects the damage automatically. ACM, Geodesic Active Contour Model are implemented with the boundary detection methods.

[4].Tian proposed a system to verify fracture in femur bones based on measuring the neck-shaft angle of the femur. Gradient, random field intensity features extracted from the images and sent to SVM classifiers. Combination of 3 classifiers improves the accuracy, sensitivity, it has been observed.

[5]. San Myint, Aung soe khaing, Hla myo tun described the image processing technique to detect the bone fracture. The fully automatic detection system of fracture in leg bone has been developed and conclusion is made that the performance of the detection method affected by the quality of the image. In feature extraction step, they used paper uses HT method for line detection in the image.

3. METHODOLOGY

The following are the steps carried out to find the radius of bone fracture

3.1 Preprocessing

In this stage noise is removed from the image by using low pass filter, contrast feature enhancement of the image and texture analysis of the image has been carried out by this performance of the result will be improved one. Next preprocessed image is taken for further processing of the image. Common type of noises present in the x-ray image are salt and pepper noise which occur during capture of image , shaking of capturing machine, intensity of light during capture of image leads to blur and unwanted dark and light dots, lines in the image. These noise can be removed by applying filters, in the project weiner filter is used for smoothing of the image and adaptive histogram equalization is used for contrast enhancement of image. It vanishes the additive noise and inverts the blurring simultaneously. This kind of filtering is optimal in terms of the mean square error. It minimizes the overall MSE in the process of inverse filtering and noise smoothing. Wiener filter has two separate parts, an inverse filtering part and a noise smoothing part. It performs the de-convolution by inverse filtering but also removes the noise with a compression operation. The weiner filter shows the smoothened and edge sharpened images with less time.

3.2. Segmentation

Image segmentation is typically used to locate objects and boundaries (lines, curves, etc.) in images. More precisely, image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain characteristics.

FCM algorithm used to segment the image. In the FCM data set is grouped into groups and each data point in the data set belongs to each cluster to some extent. If the data is equal, the points belonging to a cluster, and if different, the data points, belonging to different clusters.

Fuzz c-media (FCM) is the fuzzificada version of k-means algorithm. It is a clustering algorithm that allows the data element to have a degree of membership in each degree membership of the group. It was developed by Dunn and bezdek. It is widely used in image segmentation and pattern recognition. The steps of the process are follows:

Step1: Choose group of N elements.
Step2: Choose N data points randomly in the data, N centroids in N groups.
Step3: Find the nearest centroid in data points.
Step4: Classify data points to group elements, where centroid located for each data point
Step5: Calculate the centroid with the data points for every group of elements
Step6: Clustering finished

The sobel operator used to find the edges on the images. And edges found could also be used as aids for other image segmentation algorithms for refinement segmentation results. In simple terms, the operator calculates the gradient of the intensity of the image at each point, giving the direction of the greatest increase possible from light to dark and the rate of variation in that direction. Using this operator to detect edges in the segmentation process reduces the search area for efficient mining region and produces outputs with less time consuming.

3.3. Fracture Detection

Feature extraction is a major stage in image processing, features may be specific structures in the image such as points, edges or objects. Two types of image features can be extracted from image content representation, namely global features and local features. Global features such as color and texture, aim to describe an image as a whole and can be interpreted as a particular property of the image involving all pixels. Local feature aim is to detect key-points or interest regions in an image and describe them.

Classical Hough transform is used for feature extraction in the project that does identification of lines, circles, ellipse in the image. For detecting lines, first thing is to binarisation using thresholding and then Hough accumulator is used to find a minimum line length, and the line gap present in the image.

i. The steps involved in finding the lines are as follows:
Step1: Compute edge magnitude from input
Step2: With edge detection, simple low-pass filter is applied
Step3: Threshold the gradient magnitude by N pixels of Image is obtained.
Step4: Define parameters and variables.
Step5: Sets of pixels that make up straight line
yi = axi + b.

ii. For finding the circles in image the steps involved are as follows
Step1: Thresholded edge image as input
Step2: Specify subdivisions in the ρ θ-plane
Step3: Examine the counts of the accumulator cell for high pixel concentrations.
Step4: Examine the relationship between pixels in a choosen cell.
Step5: Set all A [a,b,c]=0
Step6: Gradient magnitude g(x,y),g(xi,yi) >T ∀ a, b.
Step7: $C = \sqrt{(x - a^2) + (y - b^2)}$

By using the HT, detection of lines, circles, curves in image has become easy work. With the help of lines and circles found from the HT method radius of the fractured bone has been detected with efficient and accurate results compared with other feature extraction methods.

4. RESULTS AND DISCUSSION

For analysis the performance of the proposed system, the experiment is conducted on 20 bone fractured x-ray images. Among these images 18 images shows the radius of fracture region thus the proposed system shows about 90% accuracy of the result. And also the proposed system shows the better result for two fractures in a single bone but the system it consumes for time for the detection. The Figures shows the result of proposed system with each stage to find radius of bone fracture in x-ray images. (a) is the input x-ray image, (b) is the preprocessed image, (c) segmented image, (d) is the fractured extracted image with these features, radius of fracture is calculated

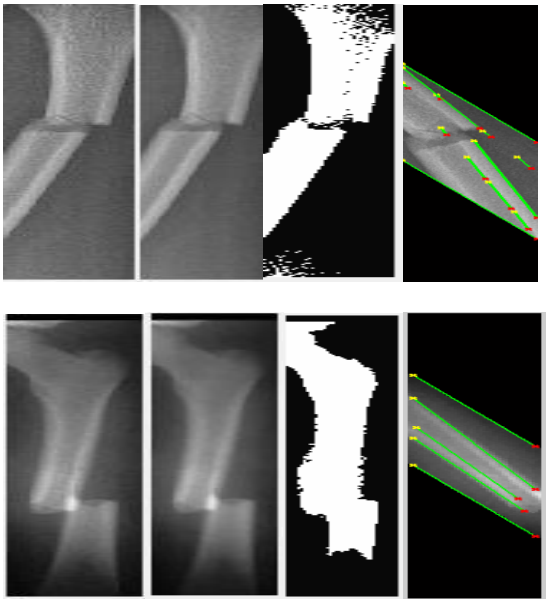

Figure1: (a) (b) (c) (d)

Table. 1. X-ray images with different sizes taken and radius of fracture obtained in mm.

Trail No	Dimension of Image	Radius of fracture detected in mm
1	43x250	0.994718
2	53x251	0.980155
3	86x241	0.989587
4	95x187	0.985764

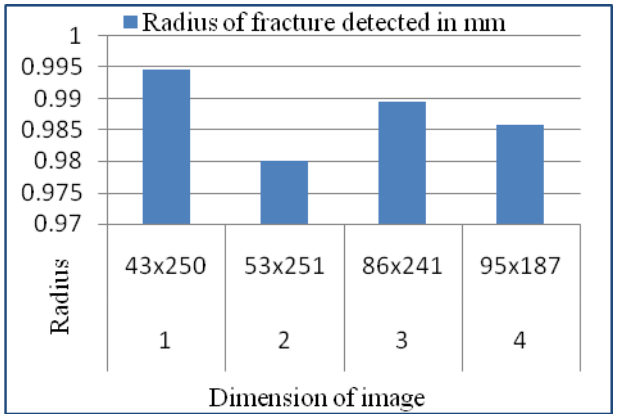

Figure 2: Graph based on the table1specification.

5. CONCLUSION

The algorithm can be applied to any bone of the body for the fracture detection. Proposed algorithm that detects the two fractures in a single bone and hence it consumes more time. The system can be further enhanced by using robust algorithm. The future advancement for the project is to include development of the robust algorithm which helps to find out the multiple fractures with minimum processing time and to produce the efficient, accurate output. Enhancement proposed algorithm which should applicable to the CT, MRI images.

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