IJCSE International Journal of Computer Sciences and Engineering Open Access
Research Paper Vol-6, Special Issue-4, May 2018 E-ISSN: 2347-2693

A Novel Cinch Automatic Bone Fracture Detection Algorithm

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Available online at: www.ijcseonline.org

***Abstract*—** In recent years the computer vision field grown enormously and provides solutions to various other fields particularly like medical domain. Therefore many researchers contributed plenty of algorithms to support diagnosis. This proposed cinch bone fracture detection is a novel, easy, and effective algorithm for bone fracture using object counting in Leg bone or tibia. It automatically detects fracture & non-fracture in a leg bones.

***Keywords*—** Bone fracture, X-ray, Color images, Object Count, Connected Component.

I. INTRODUCTION

There is a increasing development of computer usage in the field of medical domain. The field of medical imaging witnesses the advances not only in acquisition of medical images but also in its techniques of interpretation. Such systems called Computer aided diagnosis (CAD) systems. They prove that are very useful in analyzing large volumes of medical data, as well as improving the accuracy of interpretation with reduced diagnosing time [1].

Normally human suffer from many diseases and the most common among them is bone fracture. In Bone fractures may break into pieces or there may be some crack accident on accidents. The various types or levels of bone fractures like normal, transverse, comminuted, oblique, spiral, segmented, avulsed, impacted, torus and greenstick. These fractures are needed to be treat appropriately depends on the nature of the types. Hence the diagnosis and treatment of bone fracture treatment fully depend on the initial analysis. Due to the agility and the effortless nature of X-ray images are prioritised.

Most of the orthopedic suggest X-ray images to checkout with the existence and to locate the fracture region on the way. For the recovery process, doctors again suggest x-ray images to confirm the recovery of the injured bones and joint. There exist many types of x-ray images, Such as normal x-ray images, angiograms, x-ray microscopic images, mammography images and fluoroscopic images, etc.

Hence the designing of CAD systems for bone fracture detection is divided into sub-sections based on X-ray, CT, MRI and Ultrasound modalities.

The traditional way of scanning X-ray images are not efficient all the time and it requires expert's proposal for diagnosing. Using this proposed work surgeons are able to do their work with much perfection because it provides preprocessing to present clearer view of the X-ray images. In addition to that the case history X-ray images can be saved and it can be further clarified by the surgeon to go through the case study of the patient again. This adds more clarity in.

The general bone fraction detection methods found in literature are explained in section II. The proposed cinch bone fracture detection algorithm is given in under section III. The results and discussions are detailed in section IV and the conclusion is given in section V.

II. BONE FRACTURE DETECTION METHODS

Normal x-ray images of the bone are the most commonly used imaging modality for doctors to diagnose and treat bone diseases. There are varieties of techniques used to detect bone fractures found in literature. The broad categories found are X-ray image enhancement and fracture detection. Among them most of the techniques are developed for enhancement using filtering algorithms which improves the quality of the X-ray image and simplifies the diagnosing.

The algorithm developed by [Vijaykumar et .al] handles Gaussian noise by estimating the amount of noise and it is replaced instead of the center pixel by the mean of the sum of the neighboring pixels based on a threshold value [7].

The algorithm developed by [caylak] uses a technique to improve the image quality using Mean Absolute Error (MAE) and higher Peak Signal-to-Noise Ratio (PSNR) [5]. The algorithm by [Al-Khaffaf H et al]., uses the K-fill technique to remove salt and pepper noise in a 3×3 window [3].

The algorithm developed by [**Sachin R., et al**].,automatically detects fracture in X-Ray images using contrast enhancement, homomorphic filtering,and the features are extracted using wavelet and Haar transform [12]. But the fracture detection was normally performed by edge detection and the alignment displacement techniques. Generally for X-ray image segmentation of bone fractures, a number of edge detection algorithms like sobel, prewitt, roberts and canny were used. [**SP.Chokkalingam and K.Komathy**] developed a diagnosing system to detect rheumatoid arthritis by edge detection and segmentation techniques [8].

The edge detector based algorithm developed by **[R. Aishwariya et al**]., uses the canny algorithm to locate the edges whereas the algorithm by [**Anu T C, Mallikarjunaswamy and M.S Rajesh Raman**] uses sobel edge detector for their CAD based bone fracture detection in X-ray/CT images. [2][16]. But the filtering algorithm developed by [**Mahmoud Al-Ayyoub et a**l]., for hand bone X-ray images uses median filter and sobel edge detection method to remove the noise and to detect edges[11].

The techniques used with bone fracture detection vary as object count, wavelet based, svm based and morphological based. The CAD based algorithm developed by **[Hum Yan Chaiand Lai Khin]** improves the current manual inspection of X-ray imaging system using GLCM feature[4]. **[Sharma, N. and Aggarwal, L.M]** developed a classification fracture detection using transform to detect femur fractures by computing the angle between the neck axis and shaft axis [13].

[**Chan, K.-P et al**]., used wavelet, curvelet and Haar transform[15]. Whereas [**Lim, S. E at al]** [1] uses combined Support Vector Machine (SVM) classifier to improve the overall accuracy and sensitivity instead of an individual classifiers[10]. The wavelet approach developed by [**Tanudeep Kaur and AnupamGarg**] uses Multilevel wavelet with FCM and Gabor filter for x-ray bone fracture detection [6].

The algorithm developed by [**Y Jia and Y Jiang**] outlines fractured bones in an X-ray image and display the alignment between the fractured bones using Geodesic Active Contour model with global constraints was applied to segment the bone region [10].

The morphological detection based algorithm by [**Swathika.B et al**]., uses morphological gradient to remove noise and enhances image details and highlights the fracture region[14]. But the morphological method otsu algorithm developed by [**Jian Liang et al**]., detects fractures in tibia bones. Initially, the image was divided into small regions then automatically thresholded using Otsu method [9].

Amid all bone fracture detection techniques object counting algorithm is a straightforward and undemanding method. Usually these methods take two consecu-tive images as input and return the locations where differ-ences are identified. They aims to locate only the changes that are due to structural changes in the scene, i.e. a object counting [17].

The change detection algorithms implemented in these bones provide low-level information that can be used by higher level algorithms to determine the information desired the count of an object. Object counting and extraction from the fixed background in the analyzed scene is mostly done by simple subtracting the current image and background image. The only limitation of these methods is the requirement of normal image. But this proposed work overcomes this problem. It does not need normal image instead it works with the threshold value. This adds benefits to this work. The detailed discussion of the proposed work in the following section.

III. PROPOSED WORK

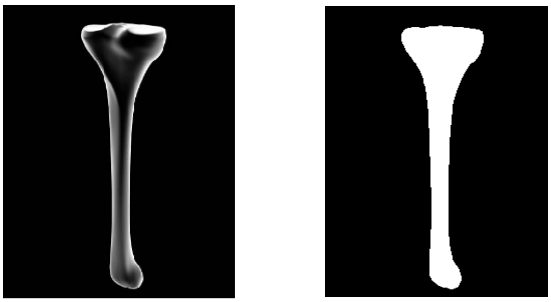
This proposed algorithm is intended to detect bone fracture automatically using connected component object count. The algorithmic description of the proposed technique is given herein under:

ALGORITHM:

1. Read an input image
2. Convert the colour image or graycale image into
3. Compute Black and white image
4. Perform morphological close operation
5. Compute residual image using image fill
4. Count the number of objects in the black and white image.
5. Set threshold with normal count value.
6. If the count exceeds the normal value
   display message as no fracture.
   else
   display message as no fracture.
7. end

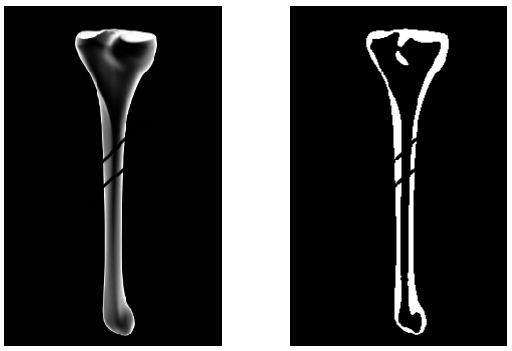
IV. RESULTS AND ANALYSIS

The proposed work is implemented using MATLAB. This method gets a colour image or a grayscale image as an input and it converts into black and white image. Then perform morphological close operation. It fills the gaps to attain residual image using image fill. After that the number of objects in the black and white image is counted. A threshold value with normal count is assigned and it verified with the normal value. Based on the threshold the existence of fracture is displayed as a message. The performance of the proposed technique is depicted in Fig. 1- Fig. 4.



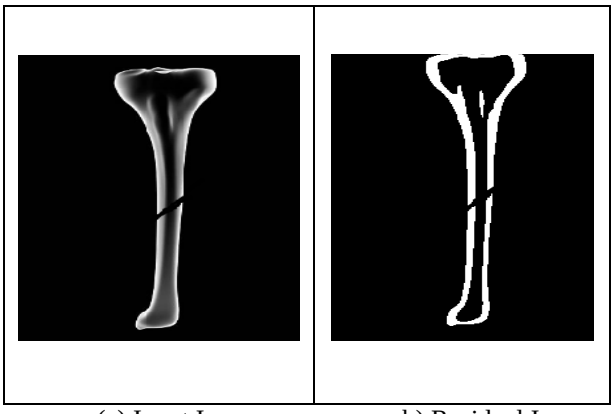
(a) Input Image (b) Residual Imag

(c) Fracture Detection
Fig.1 Fracture Detected Process Sample 1



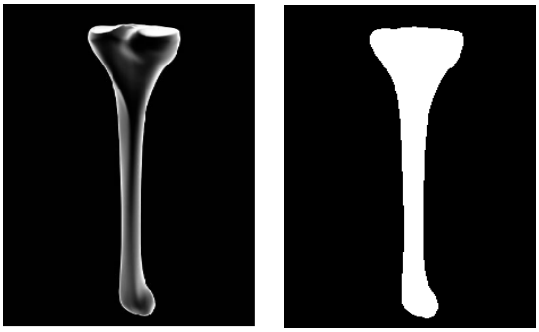
a)InputImage b) Residual Image

(c) Fracture Detection
Fig. 2. Fracture Detected Process Sample 2



(a) Input Image b) Residual Image

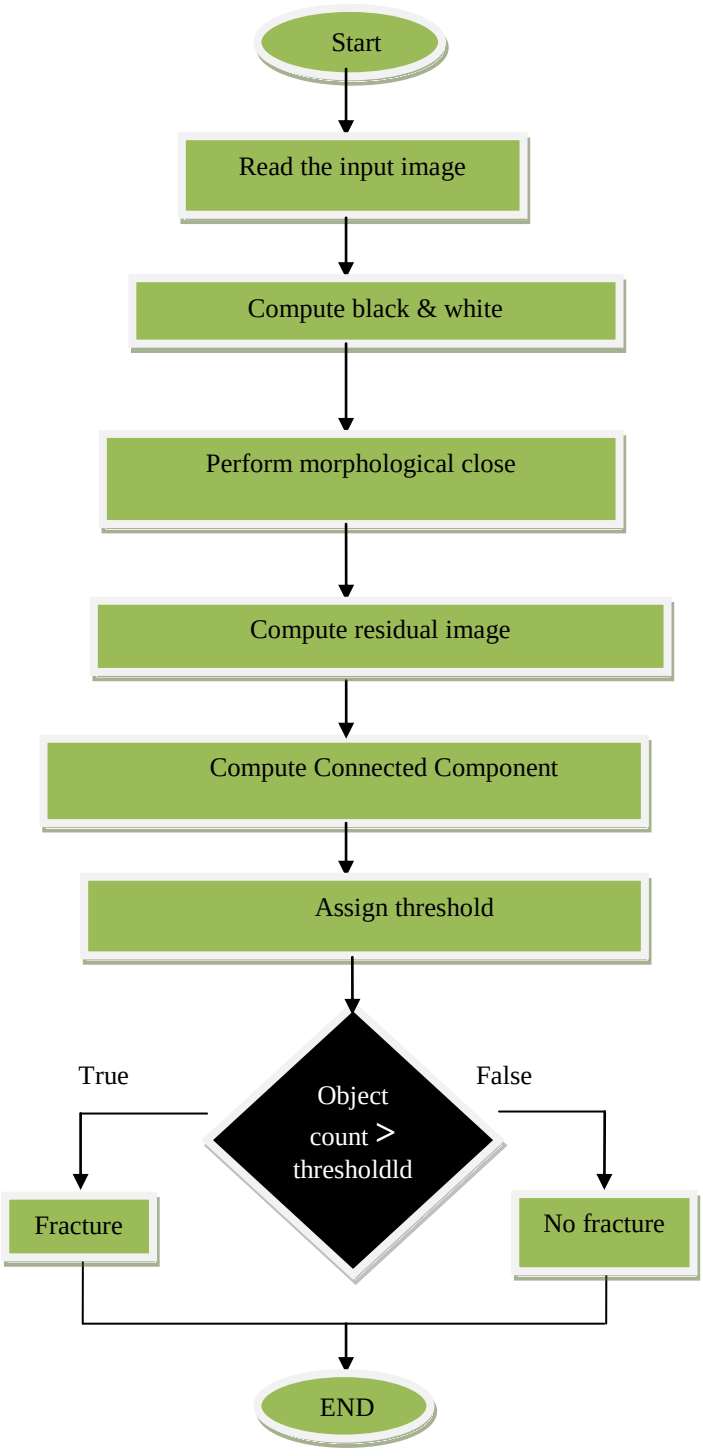
(c) Fracture Detection
Fig.3 Fracture Detected Process Sample 3



(a) Input Image (b) Residual Image

(c) Fracture Detection
Fig. 4 Fracture Detected Process Sample 4

Flow Chart



V. CONCLUSION

Te X-ray medical imaging plays a vital role in diagnosis of bone fracture in human body. The X-ray image helps the medical practitioners in decision making and effective management of injuries. In order to improve diagnosis results the stored digital images are further analyzed using medical image processing. All these features are supported by the proposed work. It effectively detects fracture in the tibia bone. In future study the type of fracture can also be intended to include in this work.

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