A SURVEY FOR FRACTURE DETECTION IN HAND BONE X-RAY IMAGES

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ABSTRACT

Medical imaging systems have been used in various medical application domains like trauma center orthopedic, pain management and vascular and non-vascular. One of the oldest and frequently used devices to capture human bones is X-ray. Computer aided bone fracture detection technique is mainly implemented to assist doctors to provide better diagnosis report. Bone fracture can occur in any part of human body such as the leg (tibia and fibula), hand (radius and ulna) and foot etc. The usage of medical images has been increasing tremendously due to a collection of thousands of medical images every day in medical institutions. Due to the increase in medical images there is a rising need of managing the data properly and accessing it accurately. Finding the correct boundary in noisy images is still a difficult task. It introduces a new edge following technique for boundary detection in noisy images. Use of the proposed technique demonstrates its application to diverse cases of medical images. The proposed technique can detect the boundaries of objects in noisy images using the information the fracture detection on the x-ray images is founded. This paper mainly discusses the computer aided diagnosis of fracture detection in human hand bone X-ray images. The proposed system has three steps. Namely, preprocessing, segmentation, and fracture detection.

Keywords: *X-ray image, Hand bone, Image processing, Fracture detection*

1. INTRODUCTION

Imaging technology in medicine made the doctors to see the interior portions of the body for easy diagnosis. It also helped doctors to make keyhole surgeries for reaching the interior parts without really opening too much of the body. Ct scanner, ultrasound and magnetic resonance imaging took over x-ray imaging by making the doctors to look at the body's elusive third dimension. With the ct scanner, body's interior can be bared with ease and the diseased areas can be identified without causing either discomfort or pain to the patient. picks up signals from the body's magnetic particles spinning to its magnetic tune and with the help of its powerful computer, converts scanner data into revealing pictures of internal organs. Image processing techniques developed for analyzing remote sensing data may be modified to analyze the outputs of medical imaging systems to get best advantage to analyze symptoms of the patients with ease.

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. The most common ailment of the human bone is fracture. Bone fractures are nothing but the cracks which occur due to accidents. There are many types of bone fractures such as normal, transverse, comminuted, oblique, spiral, segmented, avulsed, impacted, torus and greenstick [1]. A bone x-ray are the images of the bone in the body, such as the hand, wrist, arm, elbow, shoulder, etc. X-ray images are one of the most common types of medical images. In spite of their few limitations, they are commonly used in bone fracture detection due to their low cost, high speed, wide availability and ease of use . Even though the level of details provided by x-ray images is low compared to other types of medical images

such as CT and MRI, it is enough for bone fracture detection. Thus, this work depends only on x-ray images to diagnose long bone fractures [7], [8] The motivations of this system are: (i) saving time for patients and (ii) to lower the workload of doctors by screening out the easy case.

1.1 TYPES OF FRACTURE

Bone fractures in human are of several types. Depending on the impact of the force, some of the fractures are more severe than others. Sometimes the specific bone involved, and the age of the person and general health conditions also determine the severity. Commonly bone fractures include the hip, wrist and ankle. Fractures in hip occur most often in aged people [2].

The different types of fracture that can occur include:

- Simple fracture – otherwise called closed fracture – This is caused when a broken bone does not penetrate the skin.
- Open (compound) fracture – The bone breaks such that bone fragments project through the skin. In cases, the wound may penetrate down to the broken bone. This type of fracture is called open or compound fracture. Infection and external bleeding are common to occur.
- Hairline fracture – This type of fracture is occurring due to stress exerted in the foot or lower leg caused by activities such as jogging or running.
- Greenstick fracture – This kind of fracture occurs when the bone bends and cracks. There is no breaking completely into separate pieces. This type of fracture occurs most commonly in children because their bones are soft and more flexible than adult bones.
- Complicated fracture – This fracture occurs when supporting bones surrounding the fracture are also damaged and injured. This may result in injury to the arteries, veins and nerves. There may also be injury to the bone lining.
- Avulsion fracture – Muscles are anchored to the bone by structures called tendons. These are said to be a type of connective tissue. Powerful muscle contractions can cause the tendon to come out free, leading to pull out pieces of bone. This type of fracture is more common in the knee and shoulder joints.
- Comminuted fracture – In this type the bone is shattered into small pieces and this kind will take more time to heal.
- Compression fracture – This type of fracture occurs when two bones are pressed against each other. The bones of the spine,(vertebrae) can have this type of fracture. Aged people with osteoporosis have higher risk of developing this kind of fracture.

2. PROPOSED TECHNIQUE

Step 1: Preprocessing
This stage consist of the procedures that enhance the features of an input X-ray image so that he result image improves the performance of the subsequent stages of the proposed system.

Step 2: Segmentation
Image segmentati is the fundamental step to analyse image and extract data from them. It is an operation of partitioning an image into a collection of connected sets of pixels. The main purpose of interest in an image which helps in an image which helps in annotation of the object scene. There are three main approaches of image segmentation which are region approach, boundary approach, and edge approach.

Step 3: Image classifier
In this step different classifier is used like SVM (Support Vector Machine), K-Nearest Neighbor (KNN), Back Propagation Neural Network(BPNN), Nave Byes(NB).

Step 4: fracture detection
The last stage of this system is fracture detection it is performed by the procedures. First, the useful features extracted from the image. And then, these features are used to detect fracture or non-fracture image.

This paper organized in following manner, Section 1, is about Introduction part. Section 2 Proposed Techniques. Section 3 is scope & motivation of this survey paper, Section 4 is Literature Survey about Abnormal Activity Detection & Face Recognition, table 1 describe different techniques used in Abnormal Activity Detection Section 5 is about Conclusion.

3. SCOPE & MOTIVATION

This survey paper gives an overview about fracture detection in human bone x-ray images aims to identify the doctors is an age old techniques, done by various methods test of a patient. This survey can help researchers to study various techniques that are used and the results that they get in order to do more advance research in the future.

4. LITERATURE SURVEY

Researchers have been working on Edge Detection and fracture detection to create a better and more efficient summary

Swathika.B, Anandhanarayanan.K, *et al.* [1], The proposed work presents a novel morphology gradient based image segmentation algorithm is proposed to detect the radius bone fracture edges. Bone structure and fracture edges are detected more accurately using proposed image segmentation method compared with other edge detection techniques like sobel, prewitt and canny. Here, the morphological gradient image clearly highlights the sharp gray level transition occurring in the fracture region.

Cephas Paul Edward , Hilda Hepzibah[2] The proposed work present a approach to detect fractures and the type is proposed. When X-ray images are examined manually, it's a time consuming process and also it is prone to errors. And so there is a great need for the development of automated techniques and methods to verify the presence or absence of fractures.

Zheng Wei, Ma Na, Sun Huisheng, *et al*.[3] The proposed algorithm is useful for feature extraction of X-ray fracture image. Region number, region area, region centroid, and protuberant polygon of X-ray fracture image are extracted by marker processing and regionprops function. Fracture line, centerline and perpendicular line of centerline are extracted based on Hough transform successfully. The angle computed between fracture line and perpendicular line of centerline is accurate. The angle is less than 30 degree by computing. So this fracture is classified into transverse fracture according to AO classification of fractures.

G.N. Talati, K. R. Jain, *et al.*[4] This paper presents a novel & more efficient kind of approach for human identification using feature vector extraction of carpus bones. We will be focusing on the adult age group (18-35 yrs.) of that person because by this time the growths of the bones are stable.

Mario Mustra, Mislav Grgic, *et al.* [5] presented a method for automatic alignment of CR bone images which show forearms and legs. The proposed method uses thresholding based on Otsu's method for optimal threshold calculation and Hough transform for detection of straight line segments from which is possible to calculate the rotation angle.

Zheng wei, Zhang Liming [6] propose the problem of automatic interpretation of fracture injury site was converted to bone shape identification in the diagram via analyzing the shape characteristic of different femur regions. Taking fracture images of the two bone regions as the research object, considering the image of the unique characteristics of femoral fractures, and in accordance with the shape features of the proximal, middle, distal part of the femur.

Mahmoud al-ayyoub, duha al-zghool [7] proposed a in this work, we presented a machine learning based system for automatic detection of fracture types in long bones using x-ray images. Several image processing tools were used to remove different types of noiseandtoextractusefulanddistinguishingfeatures. In the classification and testing phase, SVM classifier was found to be the most accurate with more than 85% accuracy under the 10-fold cross validation technique.

San Myint, Aung Soe Khaing, Hla Myo Tun[8] described the image processing technique to detect the bone fracture.The fullyautomaticdetectionof fractures in leg bone is an important but difficult problem. According to the test results, the system has been doneto detect the bone fracture. A conclusion can be made that the performanceof the detection method affected by the quality of the image. The better the image quality, the better the result system got. . In feature extraction step, this paper uses Hough transform technique for line detection in the image.

Shubhangi D.C, Raghavendra S.Chinchansoor *et al.*[9] the performance of Laplace operator in comparison with other edge detection methods in the literature, namely, Roberts, Sobel, Prewitt, and Canny's operators, which are applied to the X-ray images of femur bones.

S. Kazeminia, N. Karimi, *et al.* [10] 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. We observed that near the boundary of bone the intensity values are higher than those in the middle of bone.

Yu Cao, Hongzhi Wang, *et al.*[11] In this paper, we investigate the bone fracture detection problem in musculoskeletal X-ray images. Compared with previous work, this paper explores various types of fractures over different anatomical regions. The evaluations against SVM and single layer random forests demonstrate the effectiveness of the proposed method. The detection accuracy could be further improved by incorporating more types of local features.

N.Umadevi, Dr.S.N.GeethaJakshmi[12] In this paper, the application of ensemble classification to fracture detection in x-ray images was considered. Two types of features, namely, texture features and shape features were extracted from the x-ray images forming a total of 12 features. Three binary classifiers, SVM, BPNN and KNN were to build ensemble classification models and during training, boosting method was used.

Luis Nascimento, M. Graça Ruano[13] Present paper proposes a strategy for bone fracture identification on US images. Results show that 89% of the fractures and bone associated pathologies (within 44 images) were correctly diagnosed. These results encourage the application of US imaging for bone fracture assessment reducing as so the level of radiation induced on patients.

S.K.Mahendran1 and S.Santhosh Baboo[14] Multiple classification techniques are more popular with satellite or natural scene classification, where it has proved to be more efficient than the usage of single classifier. The limited publications mostly use SVM and Bayes classifier. Moreover, the presented works use a set of feature vectors on multiple classifiers to detect fractures.

In Table 1 Different 14 paper is described Modeling framework, learning Algorithm& Techniques used for implementation in each paper.

Table 1 Common Tools And Paradigms In The Literature

Edge detection Techniques, Image classifier algorithms	References
Morphology gradient	[1], [2], [3],[5],[10],
Canny, Robert, Sobel, Prewitt, Laplacian, edge detection	[1],[4],[5],[7],[8],[9],[10],[13],
Threshold techniques, otsu's method	[1],[2],[4],[5],[8],[10]
SVM, Neural Network(NN), Nave Byes(NB), KNN,BPNN,SRFFF	[7],[4],[6],[9],[11],[12],[14]
Hough transform, Harris	[2],[3],[5],[6],[7],[8],[14]
Gray Level Cooccurence Matrix (GLCM),Gabor	[10],[11],[12],[14]
Fuzzy Method	[10],[14]

5. ACKNOWLEDGMENTS

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6. CONCLUSION

In this survey paper we have studied about different edge detection techniques and studied various types of different activity. Furthermore, it also includes the survey & different techniques.

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