"Bone Fissure Detection in Digital X-ray images by using Image Processing"

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ABSTRACT

The image processing technique is extremely helpful for several applications like biomedical, security, satellite imaging, personal image and medicine etc. The implementation of image processing such as image enhancement, feature segmentation and feature excitation are used for fracture detection. The uses canny edge detection methodology for segmentation. The canny method produces perfect information from the bone image. Bone fracture is a common problem in every developed countries and the number of fractures also increasing day by day very rapidly. A bone fracture may occur due to simple accidents or different types of diseases. There are mainly four types of bone demonstration X-ray, CT, MRI and Ultrasound. But X-ray diagnosis is commonly used for bone fracture detection due to their low cost, high speed and wide availability. Although CT and magnetic resonance imaging pictures provide higher quality pictures for body organs than X-ray pictures. Moreover, the level of quality of X-ray images is enough for bone fracture detection. The RGB image is converted into binary image. This algorithm uses Haar Cascade trained model which is trained via millions and even billions of images. It also uses canny image recognition to find shape and angle of bone. So, we will also able to find number of fragments. After the segmentation the area of the fracture is calculated. The method has been tested on a set of images. The main goal of the paper is to detect the bone fracture from X-ray images using Open CV software. Open CV in Python requires very less processing power than MATLAB so it can easily be implemented on ARM benchmark processor and single board computer.

Keywords: - X-RAY, CT, MRI, OPEN CV.

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1. INTRODUCTION

Computer vision has been expanded into the vast area of field ranging from recording raw data into the extraction of image pattern and information interpretation and work accordingly. It has a combination of concepts, techniques, and ideas from digital image processing, pattern recognition, artificial intelligence and computer graphics. Most of the tasks in computer vision are related to the process of obtaining information on events or descriptions, from input scenes (digital images) and feature extraction. The output of the Computer Vision process is image understanding [1]. Development of this field is done by adapting the ability of human vision in getting information. The primary purpose of Computer Vision is to create models and data extracts and information from images, while Image Processing is about implementing computational transformations for images, such as sharpening, contrast, among others. It also has similar meaning and sometimes overlapping with In Human and Computer Interaction (HCI). HCI coverage focus on full design, interface and all aspects of technologies related to the interaction between human and computer [5].

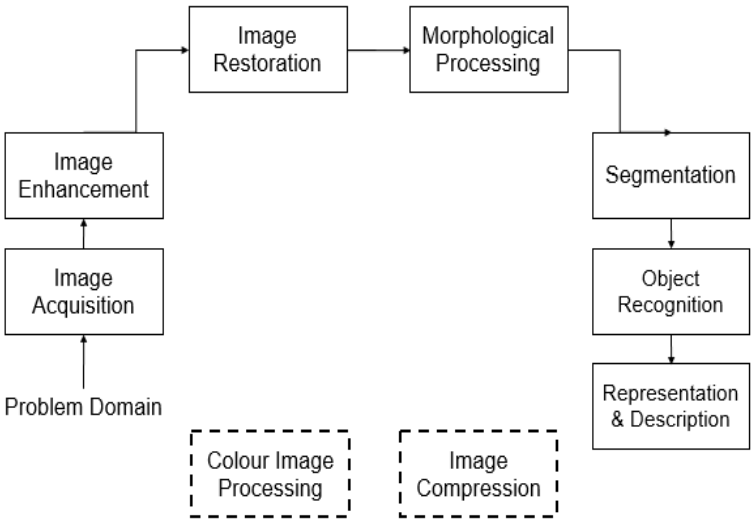

Figure 1.1 Computer Vision

1.2 Types of Image Processing

i. **Analog Image Processing** - Visual strategies for picture planning can be used for the printed forms like printouts and photographs. Picture agents put cash on various nuts and bolts of interpretation while using these visual methods. The photo getting ready isn't just kept to a locale that must be considered anyway on the learning of the specialist.

ii. **Digital Image Processing -**Digital Processing methodology help responsible for the mechanized pictures by using PCs and a rough data of the imaging sensors from satellite stage contains needs. It needs to experience three general stages like pre-preparing, improvement and show, data extraction to acquire creativity of data.

1.3 X ray Imaging

An X-ray, or, much less commonly, X-radiation, is a penetrating form of high-energy electromagnetic radiation. Most X-rays have a wavelength ranging from 10 picometers to 10 nanometers, corresponding to frequencies in the range 30 petahertz to 30 exahertz (30×10^{15} Hz to 30×10^{18} Hz) and energies in the range 124 eV to 124 keV. X-ray wavelengths are shorter than those of UV rays and typically longer than those of gamma rays. In many languages, X-radiation is referred to as Rontgen radiation [2]
The discovery of X-rays and the invention of CT represented major advances in medicine. X-ray imaging exams are recognized as a valuable medical tool for a wide variety of examinations and procedures. They are used to:

- noninvasively and painlessly help to diagnose disease and monitor therapy;
- support medical and surgical treatment planning; and
- guide medical personnel as they insert catheters, stents, or other devices inside the body, treat tumors, or remove blood clots or other blockages.

Figure 1.2 Bone and joints

2. LITERATURE SURVEY

Binash Shikah, Munira Ansari, Dhanshree Pansare, Sajid Khan (2021): based efficient system for a quick and accurate classification of bone fractures based on the information gained from the hand gesture and X-ray image. X-ray image of the fractured bone is obtained from hospital and processing techniques like pre-processing, segmentation, edge detection and feature extraction methods are adopted.

Rodrigo Moreno (2020): universal approach able to classify all the fractures in the human body has not yet been defined. We aim to analyze and evaluate a selection of papers, chosen according to their representative approach, where the authors applied different deep learning techniques to classify bone fractures, in order to select the strengths of each of them and try to delineate a generalized strategy.

Oishila Bandyopadhyay, Arindam Biswas, Bhargab B. Bhattacharya (2020): propose a new technique of automated fracture detection for long-bone *X*-ray images based on digital geometry. The method can trace the bone contour in an *X*-ray image and can identify the fracture locations by utilizing a novel concept of concavity index of the contour.

Peruri Seinivasulu (2020): produce canny method produces perfect information from the bone image. The main aim of this research is to detect Bone fractures using image processing using MATLAB. The proposed system has the following steps, namely, preprocessing, segmentation, and fracture detection in feature excitation step, the paper uses to Hough Transform technique for line detection inline-image.

Alvin Rajkumar (2019): provides an overview of the development of intelligent data analysis in medicine from a machine learning perspective: a historical view, a state-of-the-art view, and a view on some future trends in this subfield of applied artificial intelligence. It presents a comparison of some state-of-the-art systems, representatives from each branch of machine learning, when applied to several medical diagnostic tasks.

3. PROBLEM FORMULATION AND OBJECTIVE

3.1 PROBLEM FORMULATION

The processing picture is given as input to system is X-ray image. When the skewness gets raised, the approach needs to propose which remove skewness from the picture for the detection of characters. The feature extraction techniques are proposed for the bone fracture detection. In first step picture is converted to black and white picture,

so size of picture get reduced and processing time is much smaller than bigger one. Then image is resized so that output of every picture is same which will not depend upon size and total number of pixels in image. In third step is apply Thresholding is used to Separate out regions of an image corresponding to objects which we want to analyze. This separation is based on the variation of intensity between the object pixels and the background pixels. To differentiate the pixels, we are interested in from the rest (which will eventually be rejected). The fourth step is Morphological transformations are advance operations based on the image shape after thresholding to remove noise in processing image. It is normally performed on binary images. It needs two inputs, one is our original image and second one is called structuring element or kernel which decides the nature of operation. Two basic morphological operators are Erosion and Dilation. Next step and main step image are converted to canny image. Canny image contains border of bone so fracture can be easily detected. After canny edge detection the last and main step is contours. Contours can be explained simply as a curve joining all the continuous points (along the boundary), having same color or intensity.

3.2 Objectives

Following are the various objectives of this research work: -

1. To study and analyze various techniques for bone fracture detection
2. To propose bone fracture detection technique based on canny method.
3. Implement proposed system and compare with existing in terms of accuracy, precision and recall.
4. For better recognition new method were developed.

3.3 Flow Chart

The method to solve above mention problem and to fulfill the proposed objective is described here in figure. 3.1

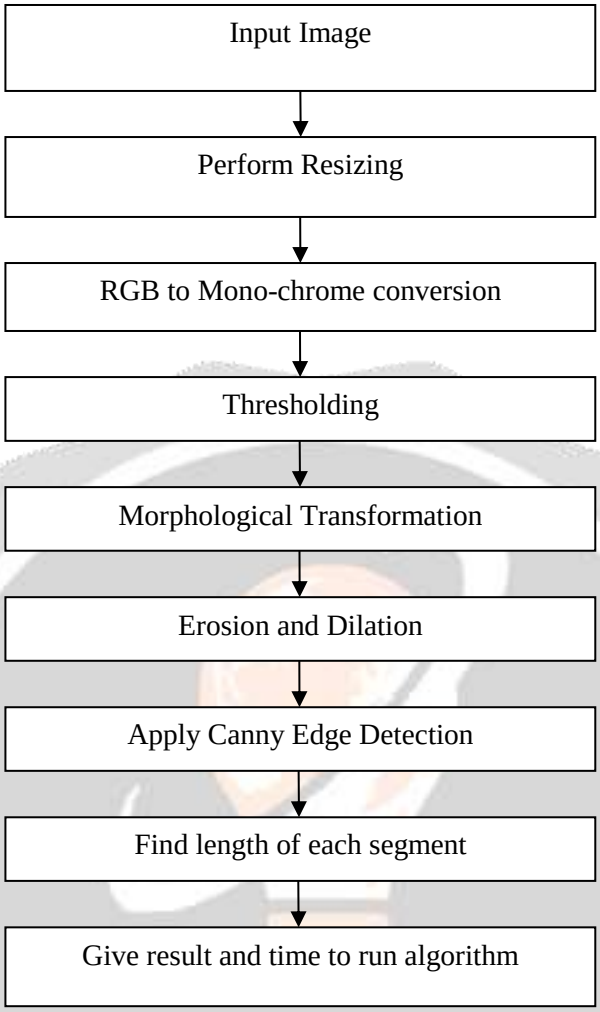

Figure 3.1: Flow-chart of Proposed Technique

4.RESULTS

Contours can be explained simply as a curve joining all the continuous points (along the boundary), having same color or intensity. The contours are a useful tool for shape analysis and object detection and recognition. Using contour detection, we can detect the borders of objects, and localize them easily in an image. It is often the first step for many interesting applications, such as image-foreground extraction, simple-image segmentation, detection and recognition.

- For better accuracy, use binary images.
- So before finding contours, apply threshold or canny edge detection.
- Since OpenCV 3.2, find Contours() no longer modifies the source image but returns a modified image as the first of three return parameters.
- In OpenCV, finding contours is like finding white object from black background.

Figure 4.1 Final Result

Image	**Processing Time**	**Accuracy**
Bone1.jpg	600ms	88%
Bone2.jpg	551ms	81.5%
Bone3.jpg	781ms	90.4%
Bone4.jpg	565ms	85.4%
Bone5.jpg	852ms	92%
Bone6.jpg	563ms	91.5%
Bone7.jpg	587ms	87.9%

5.1 CONCLUSION

Image processing plays vital role in today's world. It has important application in biomedical field. It is a method to perform some operations on an image, in order to get an enhanced image or to extract some useful information from it. It is a type of signal processing in which input is an image and output may be image or characteristics/features associated with that image. Nowadays, image processing is among rapidly growing technologies. Bone fracture detection and removal is one medical issue that still remains challenging in field of biomedicine. Early imaging techniques had the drawback of being invasive and hence the X-Ray and MRI imaging technique help the surgeons in providing a better vision. The main goal of the feature extraction using 3-level Daubechies wavelet transform technique is that the approximation coefficients usually contain the most important information (low frequency).

This research work proposed a Modified Technique for X-ray Categorization using Feature detection. Various techniques are developed in the past to detect brain tumor. Proposed technique is implemented using Python and OpenCV tool and various parameters are used to compare the results if the proposed technique with the existing technique.

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