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Bone Fracture Detection using Digital Imaging Processing

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ABSTRACT

A crack (not only a break) in the bone *is also known as a* fracture.*Causes of bone fractures include trauma, overuse and diseases that weaken bones.The main symptom is pain. There may also be loss of functionality depending on the area affected.Treatment often involves resetting the bone in place and immobilizing it in a cast or splint to give it time to heal. Sometimes, surgery with rods, plates and screws may be required-Rays are one of these techniques for detection of bone fractures. Sometimes the size of fractures is not significant and could not be detected easily. Therefore, effective and intelligent systems should be designed. This idea proposes a model to detect the minute bone fractures without using MRI, CT scan methods, but using the input as X-rays with the help of digital image processing.Digital image processing consists of the manipulation of images using digital computers. Its applications range from medicine to entertainment, passing by geological processing and remote sensing.The three general phases that all types of data have to undergo while using digital technique are pre-processing, enhancement, and display, information extraction. The implementation of image processing such as image enhancement and feature segmentation and feature excitation are used for fracture detection. The Canny edge detector is an edge detection operator that uses a multi-stage algorithm to detect a wide range of edges in images which is used for segmentation. The Hough transform is a feature extraction technique used in image analysis, computer vision, and digital image processing. The purpose of the technique is to find imperfect instances of objects within a certain class of shapes by a voting procedure*

KEYWORDS: *X-Ray, Digital image processing, Hough transform, canny edge detection*

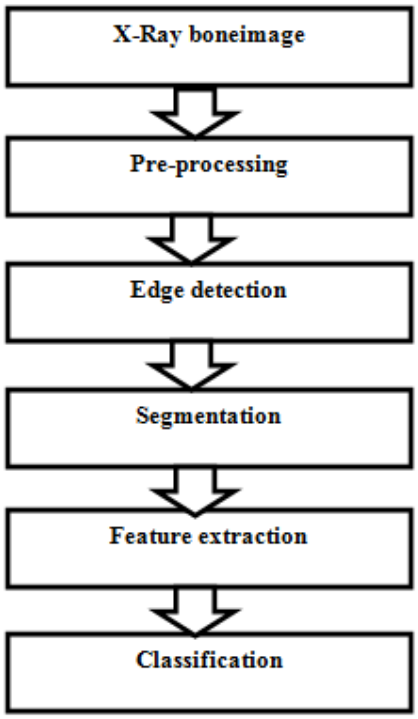
I. INTRODUCTION

The bone fracture is the most common problem and is likely to occur due to traumatic incidents like vehicle accidents, sporting injuries or due to conditions like osteoporosis, cancer-related to bones. There are different types of bone fractures occurs in most of the body parts like wrist, rib, leg, arms, hip etc. Some fractures cannot capture using X-rays. In these situations, doctor may perform other tests, such as a computed tomography (CT) scan, magnetic resonance imaging(MRI),or a bone scan. Stress fracture symptoms can relatively unnoticed in a person and may become known only after a bone has broken completely or another injury has occurred.

Ignoring a hairline fracture due to medical analysis error can lead to a more serious fracture or break occurring, which is more difficult to treat. If not treated or ignored, the hairline may not heal, resulting in a non-union fracture.. In some medical applications,

sensitivity in detection medical problems and the accuracy of detection are often in conflict. Detecting bone cracks by computer helps doctor to examine closely and it improves accuracy and timeliness. Hence developed such frame work which detects bone crack by image processing technique.The main aim of the paper is to detect the bone fracture from X-ray images using Digital image processing.

II. METHODOLOGY



A. X-Ray image

X-rays are a type of radiation called electromagnetic waves. X-ray imaging creates pictures of the inside of your body. The images show the parts of your body in different shades of black and white. This is because different tissues absorb different amounts of radiation.

Figure1. Input image

B. Pre-processing

Data preprocessing is a data mining technique which is used to transform the raw data in a useful and efficient format.Data-gathering methods are often loosely controlled, resulting in out-of-range values, impossible data combinations (e.g., Sex: Male, Pregnant: Yes), and missing values, etc. Analyzing data that has not been carefully screened for such problems can produce misleading results. Data preprocessing is an important step in the data mining process. The phrase "garbage in, garbage out" is particularly applicable to data mining and machine learning .

Thus, the representation and quality of data is first and foremost before running any analysis.Often, data preprocessing is the most important phase of a machine learning project, especially in computational biology.

If there is much irrelevant and redundant information present or noisy and unreliable data, then knowledge discovery during the training phase is more difficult. Data preparation and filtering steps can take considerable amount of processing time. Data preprocessing includes cleaning, Instanceselection, normalizatio n, transformation, feature
extraction and selection, etc. The product of data preprocessing is the final training set.

C. Edge detection

Edge detection includes a variety of mathematical methods that focus on identifying points in a digital image at which the image brightness changes sharply. Those set of points are typically organized into a set of curved line segments called edges. Edge detection is a fundamental tool in image processing, machine vision and computer vision, especially in feature detection and feature extraction. Applying Edge Detection algorithm to an image may reduce the amount of data to be processed and thus filter out the less relevant data, while preserving the important structural properties of the image.A line can be a small number of pixels of a different color . For a line, there may be usually one edge on each side of the line.

Image Edge Detection Operators are two types, Gradient Based and Guassian Based. They are further classified as likeRoberts edge detection, Sobel edge detection, Prewitt edgedetection,

Kirsh edgedetection, Robinson edge detection, and Canny edge detection. The canny edge operator extracts image features without affecting or altering the feature. They have advanced algorithm.

In Canny edge detection edges are identified by using some threshold values which represents the minimum threshold and maximum threshold values [min, max]. If a pixel gradient is greater than the maximum threshold then that pixel is considered to be appointing on the edge. If a pixel gradient is lesser than the minimum threshold then that pixel cannot be a point on the edge. If it is in between both the threshold values, then it's considered as a point on the edge only when it is connected to a pixel that is already on the edge or else it is rejected. It detects faint edges more efficiently even in noisy.

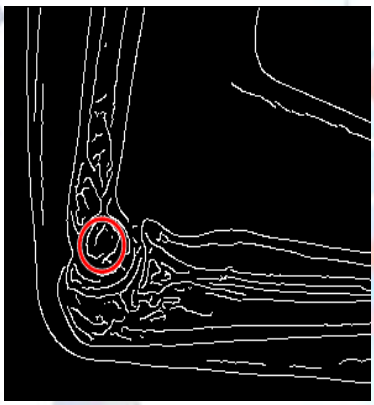


Figure2. Canny edge detection

D. Segmentation

In digital image processing and computer vision, imagesegmentation is the process of partitioning a digital image into multiple segments (sets of pixels, also known as image objects). The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyze. 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.

The result of image segmentation is a set of segments that collectively cover the entire image, or a set of contours extracted from the image. Each of the pixels in a region is similar with respect to some characteristic or computed property, such as color, intensity, or texture. Adjacent regions are significantly different with respect to the same characteristic.

E. Feature Extraction

In machine learning, pattern recognition, and image processing, feature extraction starts from an initial set of measured data and builds derived values (features) intended to be informative and non-redundant, facilitating the subsequent learning and generalization steps, and in some cases leading to better human interpretations. Feature extraction is related to dimensionality reduction.[1]

When the input data to an algorithm is too large to be processed and it is suspected to be redundant (e.g. the same measurement in both feet and meters, or the repetitiveness of images presented as pixels), then it can be transformed into a reduced set of features (also named a feature vector). Determining a subset of the initial features is called feature selection. The selected features are expected to contain the relevant information from the input data, so that the desired task can be performed by using this reduced representation instead of the complete initial data.

The Hough transform is a method which can be utilized to highlight a specific shape inside a picture. Since it shows that the ideal features can be indicated in some parametric structure, traditional Hough transform is normally utilized for the location of standard curves, for example, lines, circles, ovals, and so on. A generalized Hough transform can be utilized in applications where the basic simple feature is beyond the realm of imagination. Because of the computational nature of the generalized Hough algorithm, we focus to the traditional Hough transform.

Figure3. Hough Transform

F. Classification

Image classification refers to the task of extracting information classes from a multiband raster image. The resulting raster from image classification can be used to create thematic maps. The objective of image classification is to identify and portray, as a unique gray level (or color), the features occurring in an image in terms of the object or type of land cover these features actually represent on the ground. Image classification is perhaps the most important part of digital image analysis. It is a supervised learning problem: define a set of target classes (objects to identify in images), and train a model to recognize them using labeled example photos. Early computer vision models relied on raw pixel data as the input to the model.

III. CONCLUSION

Health is an important criterion for any human being; Bones are an integral part too. The elderly people and children have a chance of bone fractures and it is a dilemma that the fracture is not that clear in normal scanning methods especially of certain body parts, which will make them to do MRI or CT scanning's which are not affordable by everyone. Thus we came up to the idea of detecting the fractures clearly using digital image processing. The cracks in the bone can be identified accurately. Useful in medical applications to detect cracks in less time and also helps the doctors to examine closely thus identifying the cracks severe or not. So the doctor can start treatment earlier in case of severe one. It also helps the patients understand the seriousness. Here in this proposed method we are able to get a clear image, identify the type of fracture and also it is a cost effective method which is done in a most efficient manner thereby reducing the complexity of code, following and easier approach by the usage of single application alone.

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