

Bone Deformity and their Types Identification Using Machine Learning

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Abstract - Bone fracture is the global health issue, bone fracture is usually cause by accidents, falls, any injuries also due to osteoporosis and bone cancer. This paper gives us a technique to identify bone fracture and its types along with its degree and give quick results. By which workload and time of orthopedics can be reduced.

Image processing, classification, regression, edge detection and machine learning algorithms such as decision tree, convolutional neural network (CNN) are used for fracture detection. the main aim of this project is to implement our software in X-Ray machine that can give real-time result without wasting much time of orthopedics and also patients

Keywords — Bone deformity, Image processing, Edge detection, Classification, Regression, Convolutional neural network, Machine learning, Python

I. INTRODUCTION

Accident is one of the common problem in the world today and its number is increasing day by day very rapidly. The accidents can creates a deformity in the bone and also the bone deformity can be caused by injury and infection. Bone deformity simply means that the fracture in the bone. So, for that quick and accurate diagnosis crucial to the success of any prescribed treatment. Depending upon the human experts alone for such a critical matter have cause intolerance errors. Hence the thought of automatic identification procedure has perpetually been associate degree appealing one

The main goal of project is to detect the bone fracture from X-ray images using deep learning algorithms like CNN, Classification algorithms, Edge detection, Image processing, cluster, MATLAB software. The lower long bone is that the second largest bone of the body. It is made up of two bones, the tibia, and the fibula. The fibula bone is smaller and thinner than the tibia. However, the tibia fracture is most commonly occurring due to it carries a significant portion of the body weight. Among the four modalities (X-ray, CT, MRI, Ultrasound) 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, the latter is faster cheaper, enjoy wider availability and are easier to use few limitations. Moreover, the level of

quality of X-ray images is enough for bone fracture detection.

The motivations of this system are:

1. Saving time for patients to lower the workload of doctors by screening out the easy case
2. To cut back human errors as a result of doctors in hospitals manually examine an outsized variety of X-ray pictures for fracture.

Manual inspection is tedious and time consuming. A tired radiologist has been found to miss a fractured image among healthy ones. A tired radiologist has been found to miss a fractured image among healthy ones

II. LITERATURE SURVEY

The author [1], used machine learning algorithm and imaging technologies to identify the bone fracture in human body. They developed an intelligent classification system that would be capable of detecting and highlighting bone fractures and edge regression is used here to carry out the deformity classification.

In [3] research paper, used pre-processing technique based on statistical analysis have shown improvement in image noise reduction. The software scans the new input image and uses the trained ANN for defeat detection this paper presents performance of MLP and RBF for detection of defeat. Expert system and ANN can be successfully applied to provide defeat classification and overall product

quality interpretation.

In [4], DNN (Deep Neural Network) is used to classify the fracture and healthy bone. The tree experiments have been performed to evaluate the performance of the model using softmax and adam optimizer. The classification accuracy of the proposal model is 92.44% for the healthy and fractured bone using 5 fold cross validation.

In [8], they detect edges in image using edge detection algorithm and identified the fractured area in the X-Ray image of the bone using Hough transform

The authors of [10], used an anchor based faster RCNN detection model, with the backbone or ResNet-50 being constructed in multi resolution feature pyramid network (FPN) is used for locating fracture regions and classifying its types.

In [12] research paper, the classification is carried out by the artificial neural network (ANN) and the architecture of ANN consist of four layers. that is one input and output layer and two hidden layers, the number of layers defines the ANN complexity.

In the present work, we use machine learning algorithms, edge detection, image processing, classification and regression to detect bone deformity along with its degree and type of bone fracture.

III. PROBLEM STATEMENT

In recent years, bone deformity and their types detection has been widely discussed topic. After a fracture or deformity a treatment is necessary as early as possible. An orthopedic examines an X-ray or CT-Scan to detect fractured bone or type of fracture. Many times it is difficult or time consuming to find out the location of fracture and its type

Hence a efficient and robust system software needs which is capable to detect the bone fracture and their type with highlighting a fracture. This can be achieved by making a intelligent software to detect the bone deformity and their type. That help orthopedic surgeon by interpreting X-ray or CT-Scan images in a short time which reduce the workload of doctor and saves a lot time of patients and also the doctors

IV. OBJECTIVE

- To detect bone fracture and type of bone fracture using image processing
- To classify the fractured and un-fractured bone using image processing.
- Develop an intelligent classification software that would be capable of detecting and classifying bone deformity type

- The proposed software is able to detect bone dislocation with 85% success rate
- This software will ease the work of orthopedics

V. PROPOSED SYSTEM

The objective if the software is to detect the bone fracture from X-ray images using deep learning algorithms like CNN, Decision tree algorithm, Classification algorithms, Edge detection, Image processing, cluster, MATLAB software

The process of fracture detection and its type along with its degree is mainly depends on the edge detection, classification, machine learning algorithms, and image processing.

There are many machine learning algorithms to detect bone fracture and its types such as a decision tree (DT), support vector machine (SVM), k-nearest algorithm (KNN), K-means, naïve bayes, regression, classification convolutional neural network (CNN). Artificial neural network (ANN). In this paper we use decision tree to detect fracture and CNN to detect type of fracture . The initial and most basic step involves is to take an input X-Ray image. The X-Ray and CT-Scan image are obtained from the hospital that contains data about normal as well as fractured bone images. Then convert RGB to grayscale image using pre-processing technique ,and remove the noise from them.

Then the image smoothing is performed on images. Image smoothing makes the image sharper which improves the accuracy of edge detection. Then it detects the edges of the bone in the image using edge detection and after that segmentation is performed on image Moreover classification can be through of a two conditions

Decision tree and CNN classifier are used in this work. In this paper, decision tree is used to detect bone fracture or non-fracture bone and CNN is used to detect the type of fracture finally the performance of the proposed system is evaluated

Edge Detection

Edge detection is a technique of image processing used to identify points in a digital image with discontinuities. We used edge Detection in our project to detect discontinuities and edge of a bone fracture.

An Edge detection in an image is a significant local change in the image intensity , usually associated with discontinuity in either the image intensity or the first derivative of the image intensity

An edge detection is an algorithm that produces a set of edges (edges points or edge fragments) from an image.

an edge point is a point in an image with coordinates[i,j] at the location of a significant local intensity change in the

image. Edge fragment corresponds to the i and j coordinates of an edge and the edge orientation θ , which may be the gradient angle. The coordinates of an edge point may be the integer row and column indices of the pixel where the edge was detected, or the coordinates of the edge location at subpixel resolution

Image processing

We use image processing to transforming x-ray image into digital form and perform operations on it to detect and highlight the bone fracture.

Digital image editing or as sometimes referred as digital imaging is the manipulation of digital images using an existing software application such as Adobe Photoshop or Corel paint. The implementation of image processing such as image enhancement and feature segmentation and feature excitation are used for fracture detection. The main aim of this research is to detect Bone fractures using image processing using MATLAB.

Following are the steps which will be followed during processing

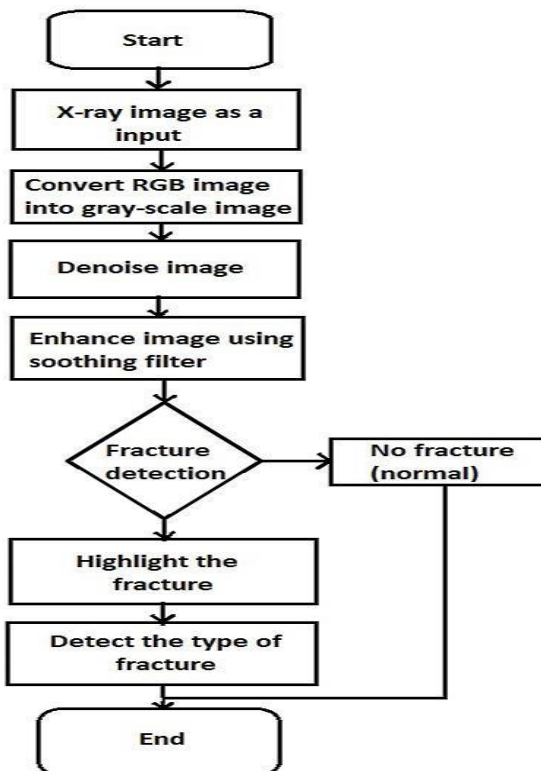


Fig. 1. Flow Chart

VI. SOFTWARE / HARDWARE REQUIREMENTS

Software Requirements-

- Matlab software
- Programming Language - Python(3.8)
- IDE - VisualStudio Code

- Operating System – Windows7 Onwards

Hardware Requirements-

- Processor – 2GHz
- RAM – 4GB
- IO Device – CPU, Mouse, Keyboard

VII. OUTCOMES

- Developing a software that can be used to detect bone fracture along with its degree
- Developing a software that can be used to detect type of fracture. Such as a transverse, greenstick, comminuted, oblique and spiral bone fracture
- Try to implement our software direct in a X-Ray machine

VIII. CONCLUSION

Through our research, we identified bone fracture and its type using the proposed software which saves much time. We used image processing and classification to detect the type of bone fracture along with its degree. many imaging techniques have been studied in this article such as image segmentation, edge detection, etc. such parameters ultimately defines the applicability of the techniques in the image processing. More accurate technique for recognizing bone fracture and its types in the body . Fracture types such as transverse, greenstick, comminuted , oblique, linear and spiral are classified by software to overcome the previous research work.

IX. FUTURE SCOPE

Within the scope of this study, the aim was to develop the most compatible software model for performing fracture detection in X-Ray images. In which fracture detection in X-Ray images, the aim is to provide assistance to physicians who are not specialized in their fields or especially those working in emergency services in diagnosing fracture on X-Ray image to allow them to apply the required treatments. Further in the study, an application can be develop to assist physicians, which can be used on portable device such as mobile phones, tablets and laptops by operating in real time, by studying other types of bone fractures that are frequently encountered in emergency services. In addition, if there is portable x-ray in medical vehicles sent to help in major disasters, epidemics or countries with undeveloped health systems, evaluation can be made without the need of a radiologist, regarding fracture detection X-Ray images.

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