IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

BONE FRACTURE DETECTION USING PYTHON

J.Raja Santhiya 1 , Mrs.P.Jasmine Lois Ebenezer 2

Department of Computer Applications, Sarah Tucker College, Tirunelveli-7.

Abstract: Identification of faults via computer-based techniques is a growing trend in all fields these days. Two main characteristics of Bone Fracture Detection are fast identification and high precision which is described by highly sensitive device by incorporating advanced techniques and effective resource usage. The effect of undue external stress above the limits of what the bone may tolerate is a crack in a bone or bone fracture. Canny Edge detection is an image processing technique that identifies bone fracture by utilizing automatic fracture detection efficiently and overcomes the question of noise reduction. There are many methodologies accessible in today's world for edge detection, such as Sobel, Canny, Log, Prewitt, and Robert. These processes, though, are hampered by crucial limitations such as a lack of capacity to conduct multi resolution research, culminating in the failure to identify small information during the analysis. The other major drawback of the techniques is that they operate well with high resolution and high-quality pictures, but because of their intrinsic lack of ability to differentiate between edges and noise elements, they do not work well with blurry images. The approach being suggested uses the CNN algorithm to solve these issues. The findings of the simulations carried out suggest that the approach proposed is a far more effective system for conducting edge detection on aggregate scales. The suggested system has also shown to be sufficiently resilient to retrieve the required details and do the necessary analysis on key portions of the images and manage noise in a much better way than the edge detectors currently usable.

Keywords: Machine Learning, Image processing using X-ray images, Canny Edge Detection, SVM algorithm.

1. INTRODUCTION

Today, medical imagery can be a scientific field that is gaining great heights in the sector of healthcare. It plays an important role in the designation of diseases and greater patient care and helps doctors choose options related to treatment type. Out of numerous health issues, the treatment and detection of bone fractures, that affects a large number of people belonging to every age group, is becoming necessary in the fashion society. It is also a typical disadvantage in many countries that are already developed where the fracture varieties are also increasing the cut. Fractures could take place because of an easy miss happening or also because of any disease .Therefore, a rapid and correct designation is important for any sort of treatment to be prescribed. Subsequently, radiologists as well as doctors X-ray results for determining if any occurrence

of fracture exists along with the exact type of fracture .Under the process of feature extraction, the method named Hough's transformation was applied to detect the line. Mallikarjuna Swamy M. S. focused on developing an associated grade economic imaging system for rapid and correct classification of bone fractures supported by information obtained from photographs/CT images. The present research makes use of different techniques of image processing like, extraction forms, segmentation, preprocessing, and edge detection. Such techniques are classified into the broken or unbroken bone by comparing the accuracy in various forms of python seven.8.0 victimization as the tool used for programming. They outline the exactness of the detection system of bone fractures with the eighth along with its performance and its limitations. They designed the system in four stages, in particular pre-processing, bone detection, segmentation, and feature extraction. Three different classifiers were used, like the Neural Propagation Network, the Naïve Bayes support, and the vector machine classifier during the fusion classification. They mentioned the outcomes showing a huge enhancement in classification rate as well as the detection rate.

There are 2 processes during this analysis. First, the bone strip was removed from the X-ray images using a non-linear anisotropic diffusion technique. Second, Hough's modified transformation was created with automatic detection of the height and also of the extent and direction of victimization based on the gradient of the calculation line parameter. The system has the flexibility to produce an extremely correct designation of fractures in the bones of hands by using the X-ray images. Few discriminatory photo options were also used when the noise was eliminated and improved. The performance of the system has accuracy greater than eighty-six. The characteristics of homogeneity, contrast, energy, and correlation have been calculated step by step with GLCM to classify the broken bone and also the violated bone. We tend to has also shown an associated degree accuracy obtained by the system with eighty-six percent. However, we tend to report together that the performance of such a technique can also be improved further through the use of multiple GLCM functions, which can be performed in the future to classify the bone in numerous degrees of fracture specifically.

2. LITERATURE SURVEY

In [1], a deep neural network model has been developed to classify the fracture and healthy bone. The deep learning model gets over fitted on the small data set. Therefore, data augmentation techniques have been used to increase the size of the data set. The three experiments have been performed to evaluate the performance of the model using softmax and Adam optimizer. The classification accuracy of the proposed model is 92.44% for the healthy and the fractured bone using 5 fold cross validation. The accuracy on 10% and 20% of the test data is more than 95% and 93% respectively. The proposed model performs much better than [1] of the 84.7% and 86% of the [2].

In [2], these processes, though, are hampered by crucial limitations such as a lack of capacity to conduct multi resolution research, culminating in the failure to identify small information during the analysis. The other major drawback of the techniques is that they operate well with high resolution and high-quality pictures, but because of their intrinsic lack of ability to differentiate

between edges and noise elements, they do not work well with blurry images. The approach being suggested uses the CNN algorithm to solve these issues. The findings of the simulations carried out suggest that the approach proposed is a far more effective system for conducting edge detection on aggregate scales. The suggested system has also shown to be sufficiently resilient to retrieve the required details and do the necessary analysis on key portions of the images and manage noise in a much better way than the edge detectors currently usable.

In [3], to overcome these problems, we proposed a transfer learning, Faster R-CNN deep learning model for fracture detection and classification with Region Proposal Network (RPN). Also, we retrained the top layer of the model by using inception v2 (version2) network architecture upon 50 x-ray images. This model was trained in 40k steps and its training stopped when loss remains only 0.0005. We evaluated the proposed model concerning detection and classification. We classify bone fracture x-ray images into two classes fracture and non-fracture also locate the location of fractures with a rectangle box. The overall accuracy has achieved from this method is 94% with respect to classification and detection. Our study shows that the proposed method is simple and efficient, which is worthwhile for dynamic detection, classification of fracture, now doctors and radiologists interact with more and more patient and overcome the workload. Furthermore, this approach improves the results, the run time performance and detection quality as compared to state-of-the-art techniques.

In [4], bone fractures are the major and common issues faced by many people. These fractures often occur during accidents. To predict these fractures doctors are using x-rays. Sometimes it is difficult to predict whether it is fractured or not through the x-rays manually. These x-rays show a clear picture of the damage but the main issue is that some physicians are overlooking the small fractures which may cause a lot of damage in the future to that particular person. Model which analyses and classifies the images of hand, leg, chest, fingers and wrist fractures in a clear way. There are many other techniques to detect these fractures and this project is molded by using some artificial intelligence applications using machine learning and deep learning techniques. This project investigates specifically various models dependent on Convolutional Neural Networks which helps us to provide a better solution as it is a step-by-step process of image analyzing algorithm to predict whether the bone is fractured or normal. By comparing 3 types of CNN models which are ConvNet/CNN, VGG16 & R-CNN with the same image dataset, R-CNN gave the best accuracy.

In [5], to overcome these problems, we proposed a transfer learning, Faster R-CNN deep learning model for fracture detection and classification with Region Proposal Network (RPN). Also, we retrained the top layer of the model by using inception v2 (version2) network architecture upon 50 x-ray images. This model was trained in 40k steps and its training stopped when loss remains only 0.0005. We evaluated the proposed model concerning detection and classification. We classify bone fracture x-ray images into two classes fracture and non-fracture also locate the location of fractures

with a rectangle box. The overall accuracy has achieved from this method is 94% with respect to classification and detection. Our study shows that the proposed method is simple and efficient, which is worthwhile for dynamic detection, classification of fracture, now doctors and radiologists interact with more and more patient and overcome the workload. Furthermore, this approach improves the results, the run time performance and detection quality as compared to state-of-the-art techniques.

In [6], this paper gives a technique to identify bone fracture using machine learning algorithms, by which workload for orthopedics can be reduced. The significant use of machine learning in this era of big medical data would help gather information from the available x-ray images rather than spending hours in the radiology departments. This paper presents imaging technologies used to identify bone fracture in the human body and give quick results once the x-ray has been taken.

In [7], the paper proposes a novel method, which is called boring survey based fracture detection (BSFD), to automatically detect FFP in 3D CT images. FFP appears as a tiny crack of the bone that is hard to find by surface observation. Thus, BSFD surveys the FFP by boring from the pelvic surface. It first segments the pelvic bone region from CT images. At every surface point, it bores a small quadrangular prism whose center is the point of interest. The prism is composed of voxels with CT values and is feed to a 3D convolutional neural network which predicts a probability of fracture. The proposed method was evaluated by using 110 elderly subjects with pelvic fractures. The AUC was 0.84 for training subjects and 0.77 for evaluation subjects. In addition, 3D visualization of fracture probability superimposed on the pelvic bone surface is provided for qualitative evaluation and supporting FFP diagnosis by physicians. The boring survey approach will be effective to detect FFP because the bored volume extracts the unique characteristics of tiny fractures in CT images.

In [8], the feasibility study proposes a low-cost and portable bone fracture detection method and device to help this under-served segment of patients. Drawing on previously published work regarding the automated detection of mechanical fractures using induced vibrations in an industrial setting, this paper presents a technique to replicate and improve upon manual detection techniques using a tuning fork and stethoscope by using digital signal processing and machine learning techniques. In order to make fracture detection more accessible, the prototype device presented does not require any specialized skills to operate, maintains portability, is automated, and has the potential to be manufactured inexpensively. Fractures are detected by inducing vibrations in the bone and measuring the resulting signal to detect structural defects. Using animal bones with synthetic soft tissues to replicate the dampening effects of muscle and connective tissue, machine learning models were trained and tested, achieving 93.6% accuracy. The proposed technique may also prove effective in-vivo although further testing is required.

In [9], three different bone investigation approaches are taken for discussion as Bone Mineral Density (BMD), Quantitative Measures for bone for analyzing thickness and, Algorithm based models are used for abnormality detections. The BMD test is used to calculate the life span of the bone and estimated fractural risk. The second analysis begins with quantitative measurements on different imaging techniques, which are applied to bone scan images to monitor the abnormality. The important imaging techniques of Quantitative Computer Tomography, High Resolution based Peripheral QCT, Quantitative Ultra Sound and other techniques are discussed. In model-based techniques, which automatically extracts the essential features from the image and groups them based on similar behavior, and discover the abnormal features from the image set.

In [10], the paper focuses with the measurement of BMD and segmentation of bone region in DEXA image using U net architecture. The parameters used in the architecture shown better results in terms of Dice, F1 score.

3. METHODOLOGY

Step 1: Preprocessing

These stages 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: Edge Detection

It is based on analyzing the changes in the intensity in the image. However, the quality of edge detection is highly dependent on lighting conditions, the presence of objects of similar intensities, density of edges in the scene and noise. There are different algorithms for edge detections such as Canny, Laplacian and Sobel. In our experiments, the best results were obtained by using a modified version of the Canny edge detection algorithm in which the contrast is enhanced using a histogram equalization step. This finding is in accordance with the Nadernejad et al. result shows the results of using different edge detection algorithms.

Step 3: Segmentation

Image segmentation is the fundamental step to analyses 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 4: 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 5: Fracture detection

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

1. First user must input an image to be processed; the image will then be carried filtering to remove noise that exists in the image.

2. The next step will performed after image filtering process, the image will during Canny Edge method, it will give results more visible lines on an X.

3. The system then check and combines the results of early detection canny with the Original image, then user can clearly see the shape of the bone and this combine will be processed by the system.

4. To detect the location of the fracture in the image, the system use shape detection with image matching process expressed when the line has an end, and give the result in percentage if and only if image will match with fractured image i. e. input x-ray image.

5. If image will not matched then no fractured will be detected.

6. Then final step is stop.

4. EXPERIMENT AND ANALYSIS

The given image is resampled to 256 X 256 by using the colour plane extraction in vision Assistant software. Resampling of the image is a technique used in order to convert the original image to an image with different width and/or height. Let G(x, y) be the original image and N(x, y) be the predefined resolution of the sampled image. Then the corresponding relation is given as:

N(x, y) = Height*width=256*256 pixels. (1)

The images that undergo resampling yield images having fixed geometrical dimensions with the resolution being the same.

Histogram:

Histogram Analysis is then done on the resampled image. Histogram is the graphical representation of pixel intensity (taken on x-Axis) versus number of pixels (taken on y-Axis). Let us consider 8-bit grayscale image. For this image 256 different intensities are possible and the histogram of this image will display 256 numbers graphically representing the distribution of pixels among these values only. Laplacian-Guassian filter: To find regions of rapid change in images derivative filters like laplacian filters are used. Before applying this filter it is important to smooth the image as laplacian filter is sensitive to noise. This is done by using Guassian filter. Hence forth the image

undergoes a two-step process called as Laplacian of Guassian operation and the mathematical equation is given as:

$$L(a,b)=\nabla^2 f(a,b) = \frac{\delta^2 f(a,b)}{\delta a^2} + \frac{\delta^2 f(a,b)}{\delta b^2}$$

In morphological image processing erode function is one of the basic operations that can be applied to both binary and as well as gray scale images. Gray -scale erosion of a point is defined as the minimum number of points in its neighbourhood that define the structuring element. If a(x) denotes an image, b(x) is the grayscale structuring element, the grayscale erosion of a by b is mathematically represented as:

$$(f \Phi b)(x) = inf_{y \in B} \; [f(x+y)-b(y)]$$

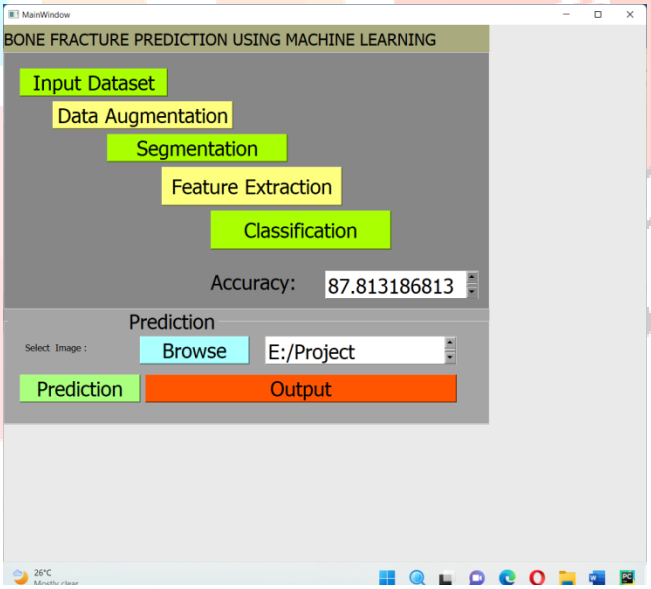

Figure 1 Main Window of Bone fracture GUI

Figure 1 shows the main window of the bone fracture detection. The accuracy is 87.81%.

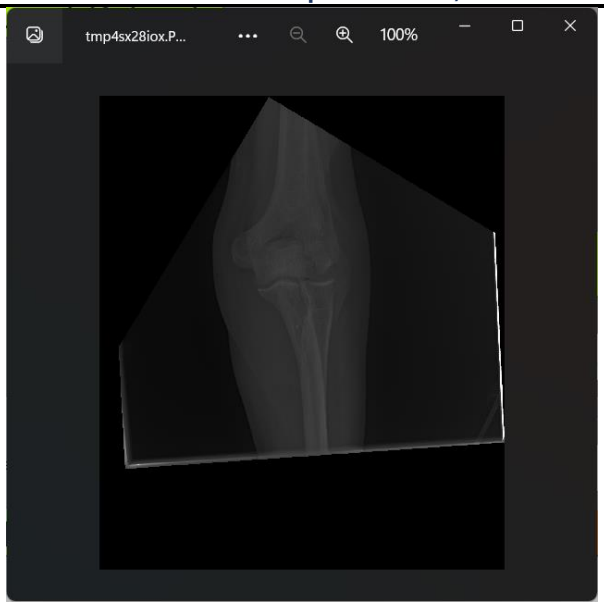

Figure 2 Input Bone Image

Figure 2 illustrates the bone input image.

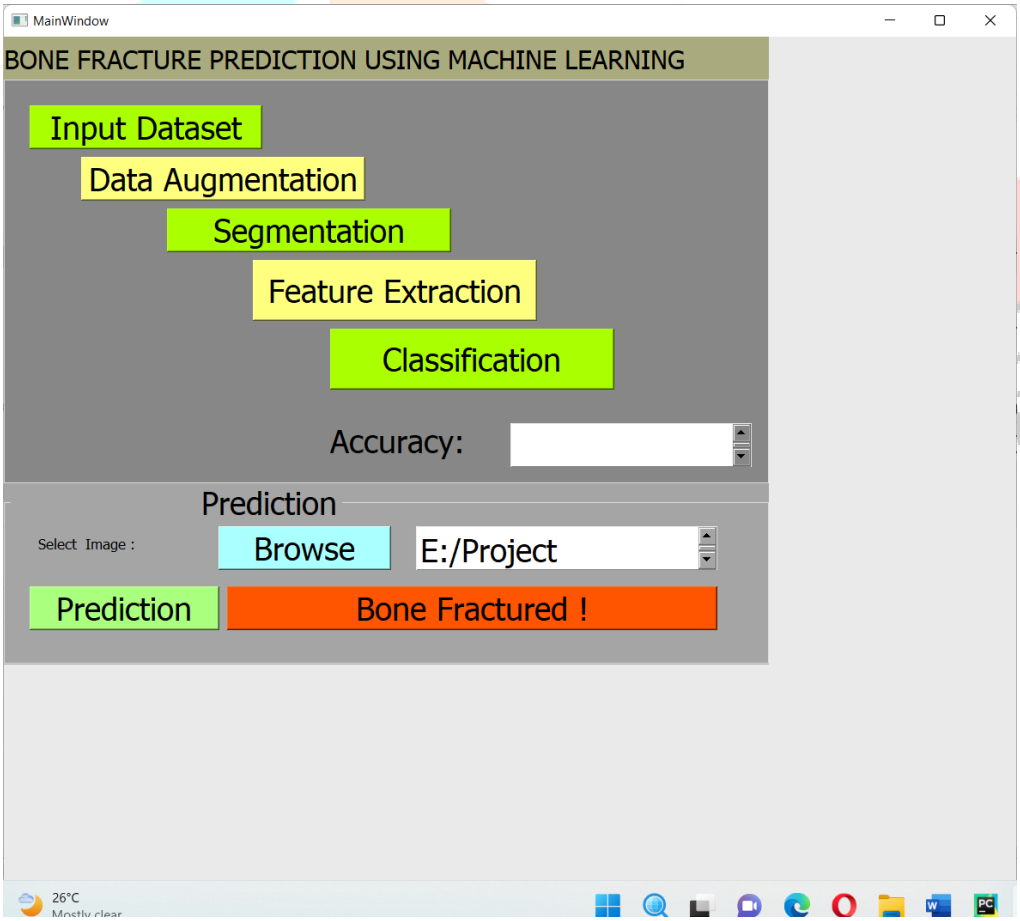

Figure 3 Predicted Output

Figure 3 shows the browse button click. When pressing browse button, the open dialog is opened. The user can select any image and click the predict button to predict the result.

5. CONCLUSION

A computer based analytical techniques for the detection of bone fracture using X-ray/ CT images has been presented in this work which starts from the preprocessing to remove the noise and edge detected by using

sobel edge detector. After the segmentation the area of the fracture is calculated. The method has been tested on a set of images and results have been evaluated. Analysis shows that results obtained are satisfactory and accuracy of this method was 85%.The limitation of this method is ,in CT and some cases of X-ray images very difficult to find the area of fracture, In future it is fully implemented to CT images and also classify the type of fracture is occurs.

6. REFERENCE

1. D. P. Yadav and S. Rathor, "Bone Fracture Detection and Classification using Deep Learning Approach," 2020 International Conference on Power Electronics & IoT Applications in Renewable Energy and its Control (PARC), 2020, pp. 282-285, doi: 10.1109/PARC49193.2020.236611.
2. 1, Shinde Shunhangi 2, Bhor Sakshi 3, Pawale Kirti 4, P.R.Patil 5 1,2,3,4Student, SAE Pune, Maharashtra, India. 5Guide, SAE Pune, Maharashtra, India.
3. W. Abbas et al., "Lower Leg Bone Fracture Detection and Classification Using Faster RCNN for X-Rays Images," 2020 IEEE 23rd International Multitopic Conference (INMIC), 2020, pp. 1-6, doi: 10.1109/ INMIC50486.2020.9318052.
4. 1Kallimpudi Bhaskara sai kiran, 2B Satyasaivani 1 PG Student, 2Associate Professor 1Department of computer science, 1GITAM (Deemed to be University), Visakhapatnam, Andhra Pradesh, India.
5. W. Abbas et al., "Lower Leg Bone Fracture Detection and Classification Using Faster RCNN for X-Rays Images," 2020 IEEE 23rd International Multitopic Conference (INMIC), 2020, pp. 1-6, doi: 10.1109/ INMIC50486.2020.9318052.
6. S. Yadahalli, A. Parmar, P. Zambare and R. Sawant, "Bone Deformity Identification Using Machine Learning," 2021 5th International Conference on Intelligent Computing and Control Systems (ICICCS), 2021, pp. 1355-1358, doi: 10.1109/ ICICCS51141. 2021.9432272.
7. N. Yamamoto et al., "Boring Survey Based Fracture Detection (BSFD) for Fragility Fracture of the Pelvis in CT Images," 2021 International Conference on Machine Learning and Cybernetics (ICMLC), 2021, pp. 1-5, doi: 10.1109/ ICMLC54886. 2021. 9737242.
8. Boger, J. Chakalasiya, K. Christofferson, Y. Wang and J. Raiti, "Induced Acoustic Resonance for Noninvasive Bone Fracture Detection Using Digital Signal Processing and Machine Learning," 2020 IEEE Global Humanitarian Technology Conference (GHTC), 2020, pp. 1-4, doi: 10.1109/GHTC46280.2020.9342913.
9. Saranya and K. Kottilingam, "A Survey on Bone Fracture Identification Techniques using Quantitative and Learning Based Algorithms," 2021 International Conference on Artificial Intelligence and Smart Systems (ICAIS), 2021, pp. 241-248, doi: 10.1109/ICAIS50930.2021.9395817.
10. S. M. N. Fathima, R. Tamilselvi, M. P. Beham and A. Nagaraj, "A Deep Learning Approach on Segmentation of Bone for BMD Measurement from DEXA Scan Images," 2020 Sixth International Conference on Bio Signals, Images, and Instrumentation (ICBSII), 2020, pp. 1-5, doi: 10.1109/ ICBSII49132.2020.9167573.