

Identification And Classification of Bone Deformity Using Machine Learning

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Abstract -- Automated fracture detection is an essential part of a computer-aided tele-medicine system. In this paper, we have work on a technique for the detection and evaluation of orthopaedic fractures from X-ray images. We have also developed a software that can be ordinarily used by paramedics or bone specialist doctors. The proposed tool first segments the bone part of an input digital X-ray image from its surrounding region and then generates the outline of bone. After that, it performs correction of discontinuity or breaks of outline of bone that might have been generated because of segmentation process, and then finally it detects the existence of fracture. In X-ray image, the bone is visible with the surrounding tissues or muscles (i.e. flesh). therefore, segmentation process is required to generate the outline of bone. Extraction of bone part from muscles and tissue shadow is a tedious task in digital X-ray image segmentation. Each X-ray image has three distinct regions - a black background region, a flesh region, and bone region .

Keywords—*Bone fracture, Image processing, Edge detection, Classification, Convolutional neural network, Machine learning, Python, spyder, Anaconda*

INTRODUCTION

Bones are the structural pillars of the human body that protect the important organs of the human body like the brain, heart, lungs and other internal organs through their rigidity. There are 206 bones in a human body with a wide range of shape, size and artifact. Fracture of bones is a fairly occurrence in humans. They can be caused due to a variety of reasons that ending up applying pressure beyond the tolerance threshold. Oblique, compound, spiral, green stick, comminuted and transverse are some of the common types of fractures that occur in humans. Electromagnetic radiation, computed tomography, magnetic resonance imaging (MRI), ultrasound, are some of the frequently used imaging techniques to detect fractures. Doctors generally employ one of these options to confirm whether an injury exists and if it exists accurately pinpoint the location of the fracture. The proposed method is a novel method that leverages images edge detection using CNN algorithm. The Graphical user interface developed provides the user with a synergistic environment. The GUI is designed keeping in mind that the end user need not know anything about the coding section. Using GUI, we can perform any calculation, communicate with any other UI

components, plot graph, create tables, etc. MATLAB GUI made it easy to process the provided images. The process involves the user providing the image which is then taken through a processing pipeline to convert it into the equivalent grayscale image. The user then selects the region that is affected and is converted into black and white for detection analysis. Finally, the area under analysis is measured and final analysis is provided.

MOTIVATION

Motivation related to resolving some issues of using external orthopedic fixation devices for healing bone injuries and in leg extension treatment. More specifically, IoT paradigm is used to design the system which would reduce the risks and associated costs of homecare recovery of the patients with bone fractures, by facilitating real-time monitoring of relevant data and classification of healing progress milestone and disturbance events. Reliability of a Bone Fracture Detection system is multifaceted. We argue that the most important ones include bone detection accuracy, Core building blocks of bone detection systems are usually embedded in wearable device using CNN algorithm, or cameras. In series of works, authors focus on improving the accuracy of bone detection system by combining several building blocks.

LITERATURE SURVEY

1. Paper Name : Bone Fracture Detection System using CNN Algorithm Author: Siva S Sinthura, Y. Pranusha, Y. Prathyusha, B. Poojitha, K. Harini

Description : Identification of faults through computer-based techniques is a growing trend these days in all fields. A highly responsive system is characterized by two key features of quick detection and being highly accurate through leverage of modern techniques and efficient utilization of resources. Break in a bone or bone fracture is the result of excess external force beyond the threshold of what the bone can withstand. Canny Edge detection is an image processing methodology to detect the bone fracture through efficient use of automated fracture detection and overcomes the noise removal problem.

2. Paper Name : A Review on Bone Fracture Detection Techniques using Image Processing Author: Mr. Rocky S Upadhyay, Dr. Prakashsingh Tanwar

Description : The bone fracture emerges as the common health challenge in human beings, which occurs due to the accident or other causes like bone cancer etc. The fracture possibly can occur in any bone of the human body like wrist, hip, heel, ankle, rib, leg, chest and so on. But sometimes the X-ray images of bone fracture lack the sufficient details required for

diagnosis. Recently, image This paper exhibits an investigation of picture preparing strategies for bone crack recognition.

5. Paper Name : Real-time monitoring of bone fracture recovery by using aware, sensing, smart and active orthopedic devices Author: Misić Dragan, Zdravković Milan, Mitković Milorad, Vitković Nikola, Mitković Milan

Description:—Although external fixation is being widely used by orthopedic surgeons in the treatment of bone fractures, the surgical procedure and recovery are still followed by a number of possible complications which can significantly decrease the treatment's efficiency (cost) and effectiveness (optimal healing). Inability of the physician to have continuous insight into different data, fracture healing process, patient's behavior and environmental factors could be considered as a reason for these complications. In this paper, we propose the improvement of a fixation device design, which implements paradigms of aware, sensing, smart and active devices and thus, enables real-time monitoring of bone fracture healing.

7. Paper Name : AUTOMATIC DETECTION OF BONE MARROW INFILTRATION BY MULTIPLE MYELOMA DETECTION IN LOW-DOSE CT Author: F. Martínez-Martínez, J. Kybic, L. Lambert Description: Multiple myeloma is a disease primarily affecting bone marrow. This paper presents a novel method that can automatically detect infiltration of the bone marrow by multiple myeloma in diseased femurs (thigh bones) from low-dose CT images. This detection is done by evaluating two aspects of the CT images: bone marrow infiltrations (increased density values compared to regular fatty bone marrow) and scalloping (indentation of the inner margin of the cortical bone). First, bone marrow and cortical bone are automatically segmented from CT images.

10. Paper Name : Bone Fracture Detection and Classification using Deep Learning Approach Author: D. P. Yadav, Sandeep Rathor.

Description:- The bone is a major component of the human body. Bone provides the ability to move the body. The bone fractures are common in the human body. The doctors use the X-ray image to diagnose the fractured bone. The manual fracture detection technique is time consuming and also error probability chance is high. Therefore, an automated system needs to develop to diagnose the fractured bone. The Deep Neural Network (DNN) is widely used for the modeling of the power electronic devices. In the present study, 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.

PROBLEM STATEMENT

The problem of edge detection is the presence of noise that results in random variation in level from pixel to pixel. Therefore, the ideal edges are never encountered in real image. A great diversity of edge detection algorithms has been devised with differences in their mathematical and algorithmic

properties of which are based on the difference of gray levels. The difference of gray levels can be used to detect the discontinuity of gray levels. From the visual inspection of the images obtained the canny edge detector is the efficient algorithm in identifying the edges clearly. This work addresses the problem of the classification of different types of fractures in the proximal humerus bone.

OBJECTIVES

- Bones are the solid organs in the human body guaranteeing various urgent organs, for instance, cerebrum, heart, lungs, etc. The human body has 206 bones.
- Each bone is having various shapes and structures.
- The longest bones are the femur bones, in addition, the softest bones are the sound related ossicles.
- There are five types of bones are available. They are, (i) long, (ii) short, (iii) sporadic, (iv) sesamoid and (v) flat.
- CNN algorithm is used to define the detection of bone.

PROPOSED SYSTEM

The aim of the system is to detect the bone fracture using machine learning algorithms.

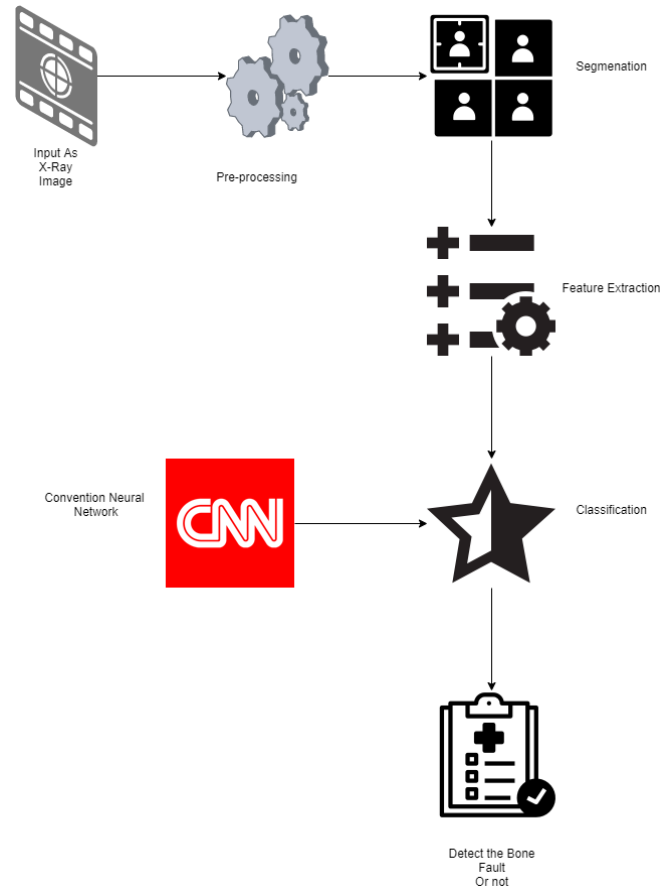
The process of fracture detection and its type is mainly depends on the classification, regression and image processing.

In this system, the X-RAY image is taken as a input after that this RGB image is converted into greyscale image. The X-RAY images were collected from hospitals. Segmentation, feature extraction, classification are performed on image.

CNN (convolutional neural network) is used to detect bone fracture.

In this paper, image processing and learning techniques are used to detect the bone deformity.

Following are the steps which will be followed during processing



HARDWARE/SOFTWARE REQUIRED SPECIFICATIONS

Software Interfaces :

- Operating System: Windows 10
- IDE: Spyder
- Programming Language : Python
- Anaconda

Hardware Interfaces :

- RAM : 8 GB
- Hard Disk : 40 GB
- Processor : Intel i5 Processor

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

CONCLUSION

A CNN based image segmentation algorithm is proposed to detect the bone fractured area using a GUI application that was developed. The affected area of the image processing results is depicted. The Affected Area Localization show that the proposed image segmentation method detects the bone structure and fracture edges more accurately even in the presence of noise when pitted against other well-known edge detection techniques like Sobel, Prewitt and canny. The proposed CNN based image segmentation algorithm clearly highlights the fractured area of an image.

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 developed 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.

REFERENCES

- [1] Edward V, Cephas Paul. and Hepzibah S, Hilda. (2015) , — A Robust Approach For Detection of the type of Fracture from XRay Images||, International Journal of Advanced Research in Computer and Communication Engineering, Vol. 4, Issue No. 3, pp.479-482.
- [2] Deshmukh, Snehal., Zalte, Shivani., Vaidya, Shantanu. and Tangade, Parag. (2015), — Bone Fracture Detection Using Image Processing in Matlab||, International Journal of Advent Research in Computer and Electronics
- [3] Rathode, Hs. and Ali, Wahid. (2015), — MRI Brain Image Quantification Using artificial neural networks – A Review Report||, ISOI Journal of Engineering and Computer science, Vol. 1, Issue No. 1, pp. 48-55.
- [4] O. Bandyopadhyay, A. Biswas, and B. B. Bhattacharya, "Classification of long-bone fractures based on digital-geometric analysis of X-ray images," Pattern Recognit. Image Anal., vol. 26, no. 4, pp. 742–757, 2016.
- [5] U. Andayani et al., "Identification tibia and fibula bone fracture location using scanline algorithm," J. Phys. Conf. Ser., vol. 978, p. 012043, 2018.
- [6] N. D. Deokar and D. A. G. Thakur, "Design , Development and Analysis of Femur Bone by using Rapid Prototyping," Int. J. Eng. Dev. Res., vol. 4, no. 3, pp. 881–886, 2016.
- [7] M. Khan, S. P. S. M. A. Sirdeshmukh, and K. Javed, "Evaluation of bone fracture in animal model using bio-electrical impedance analysis," Perspect. Sci., vol. 8, pp. 567–569, 2016. College Short Form Name, Department of Computer Engineering 2020 45
- [8] G. Narayana, "Automatic Detection of Radius of Bone Fracture," Int. Res. J. Eng. Technol., vol. 4, no. 6, pp. 4–7, 2017.
- [9] I.Khatik, "A Study of Various Bone Fracture Detection Techniques," Int. J. Eng. Comput. Sci., vol. 6, no. 5, pp. 6–11, 2017.
- [10] H. Kaur and A. Jain, "Detection of Fractures in Orthopedic X-Ray Images," vol. 8, no. 3, pp. 545–551, 2017
- [11] Zeelan Basha, C. M. A. K., Maruthi Padmaja, T., Balaji, G. N., "EAI Endorsed Transactions on Pervasive Health and Technology", Vol. 5 ,Issue 18, 1-6,2019.
- [12] P.Ganesan, S.Sivakumar, and S.Sundar, A Comparative Study on MMDBM Classifier Incorporating Various Sorting Procedure, "Indian Journal of Science and Technology" Vol 8(9), 868–874, May 2015.
- [13] Mr. Prathamesh Shrinivas Sahasrabhojane, Prof. Pramod G. Patil, Mr. Pushkar Ashok Thakur, Mr. Hrithik Sanjay Sanghavi."Augmented Reality Media (Ed.AR)", Volume 9, Issue III, International Journal for Research in Applied Science and Engineering Technology (IJRASET) Page No: 487-489.
- [14] McDonagh, John, and G. Tzimiropoulos, Joint face detection and alignment with a deformable Hough transform model, European Conference on Computer Vision, Springer International Publishing (2016).

- [15] Prajakta Dhatrak, Pramod Patil, Dipalee Shelar, Truptika Gangurde, Shruti Sonawane. "Print on Air: Implementation of a Cloud-based Printing Order Management System.", Volume 9, Issue III, International Journal for Research in Applied Science and Engineering Technology (IJRASET) Page No: 234-236.
- [16] C. I. Gonzalez, P. Melin, J. R. Castro, and O. Mendoza, An improved sobel edge detection method based on generalized type-2 fuzzy logic. *Soft Computing* 20, 773 (2016).
- [17] S. Bulut, A. Ozcan, C. C. Ofluc, O. Ozturk and A. Akpek, "A new algorithm for segmentation and fracture detection in X-ray images," 2015 Medical Technologies National Conference (TIPTEKNO), Bodrum, 2015, pp. 1-4.
- [18] Restaurant Menu Card by Using Augmented Reality Volume 9, Issue 12, pp: 26-29.
- [19] Gaurav Kumar D. K. Singh, Prof. Pramod Patil, Pooja Mahendra Sali, Rameshwari Devidas More, Mayuri Raju Pawar. "Face Mask Detection with Alert System using Artificial Intelligence: Implementation of a Pre-Trained Model in Detection of Masks", Volume 9, Issue III, International Journal for Research in Applied Science and Engineering Technology (IJRASET) Page No: 1067-1069.
- [20] Paras Patil, Pramod Patil, Swapnil Patil, Nikhil Shinde, Purab Kharchane, "AFFINITY FINDER FOR MATRIMONIAL SITE USING AI", International Journal of Creative Research Thoughts (IJCRT), ISSN:2320-2882, Volume.9, Issue 12, pp.e554-e560.
- [21] Abhishek Sasale, Pramod Patil, Abhishek Rathi, Vinit Salve, Sanket Gite, "AN INTELLIGENT SECURE QUESTION PAPER GENERATION SYSTEM", International Journal of Creative Research Thoughts (IJCRT), ISSN:2320-2882, Volume.9, Issue 12, pp.f144-f149.
- [22] Aniket Fulzele, Pramod Patil, Abhishek Thakare, Ameya Mahale, Shubham Shelake, "A MOBILE APPLICATION FOR EARLY DIAGNOSIS OF PNEUMONIA", International Journal of Creative Research Thoughts (IJCRT), ISSN:2320-2882, Volume.10, Issue 1, pp.a56-a59.
- [23] Prof. Pramod Patil, Ankita Kashmire, Pooja Kute, Pradnya Rathor, Anam Shaikh. "Tract Angle using Machine Learning", Volume 8, Issue I, International Journal for Research in Applied Science and Engineering Technology (IJRASET) Page No: 384-386.
- [24] Prof. Pramod Patil, Amruta Bhange, Shweta Jagtap, Rakshali Marathe, Swikruti Chaudhari, "MELANOMA SKIN CANCER DETECTION USING IMAGE PROCESSING.", IJRAR - International Journal of Research and Analytical Reviews (IJRAR), E-ISSN 2348-1269, P- ISSN 2349-5138, Volume.6, Issue 1, Page No pp.743-745.
- [25] Pramod.G. Patil, Sneha.A. Khaire, "Fine-Grained Knowledge In Agriculture System," International Journal of Computer Sciences and Engineering, Vol.5, Issue.10, pp.280-284.