“BONE FRACTURE DETECTION USING IMAGE PROCESSING METHODS”

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ABSTRACT

Fracture detection is a crucial part in orthopedic X-ray image analysis. Automated fracture detection for the patients of remote areas is helpful to the paramedics for early diagnosis and to start an immediate medical care. The bone fracture is a common problem in human beings occurs due to high pressure is applied on bone or simple accident and also due to osteoporosis and bone cancer. Therefore the accurate diagnosis of bone fracture is important aspects in medical field. The main goal of this project is to develop an image processing based efficient system for a quick and accurate classification of bone fractures based on the information gained from the various x-ray / CT images. Images are obtained from various hospitals and the processing of the images are performed using pre-processing, segmentation, edge detection and feature extraction methods are adopted. The obtained outcome are further classified as fractured and non-fractured compare to the accuracy of different method. Python 5.2.2 is the programming tool used. Results obtained demonstrate the performance of the bone fracture detection system with good accuracy of 99%.

Keywords

Bone fracture, noise removal, edge detection, classification, accuracy

1.INTRODUCTION

Bones are the solid organs in the human body protecting many important organs such as brain, heart, lungs and other internal organs. The human body has 206 bones with various shapes, size and structures. The largest bones are the femur bones, and the smallest bones are the auditory ossicles. Bone fracture is a common problem in human beings .A bone fracture is the medical definition for a broken bone. Fractures are usually caused by traumas like falls, car accidents or sports injuries. But some medical conditions and repetitive forces (like running) can increase your risk for experiencing certain types of fractures. There are different types of medical imaging tools are available to detecting different types of abnormalities such as X-ray, Computed Tomography (CT), Magnetic Resonance Imaging (MRI), ultrasound etc. X-rays and CT are most frequently used in fracture diagnosis because it is the fastest and easiest way for the doctors to study the injuries of bones and joints. Random Forest Classifier is used to implement in this paper.

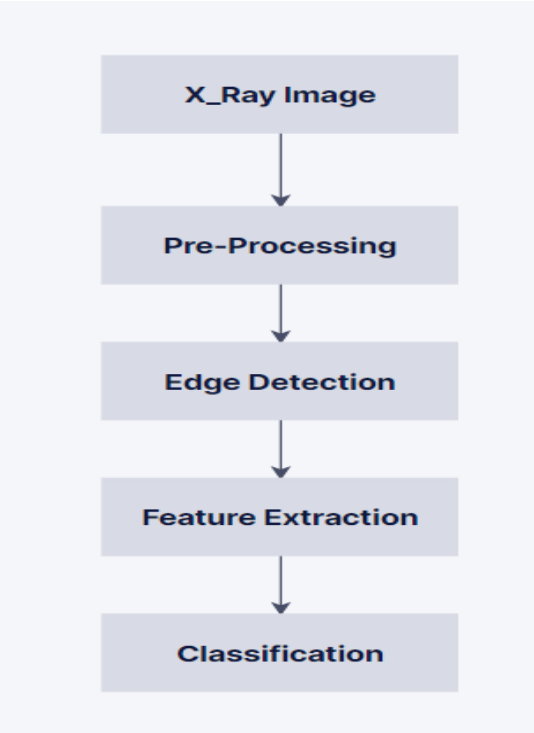
2.EARLIER WORK

There are several algorithms were developed for bone fracture detection. In this section a comprehensive overview of the literature is presented, starting with papers that Malikarjun M.S. et al.,[1] proposed a model where the dataset is collected from various x-ray/CT images. The main algorithm used in this method is K-means clustering and Sobel Edge Detection Algorithm. The future scope of this project is to improvise the model to detect the fracture area from the image/CT scan. The limitation of this method is that, in CT and some cases of X-ray images it is very difficult to find the area of fracture. In future work, it can be fully implemented to CT images and also classify the type of fracture is occurs. The proposed model gives 85% accuracy. Dhirendra Prasad Yadav et al.,[2] 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 gives accuracy of 86%. Shivam Molwane et al.,[3] 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 International Journal of Creative Research Thoughts (IJCRT) 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.

3.PROPOSED WORK

This is image processing project based on classification and detection of bone fracture .In this project, bone fracture dataset from Github is used. Multiple segmentation algorithms like Canny edge detection and Random Forest algorithm feature extraction and classification algorithm are used. These algorithms are implemented on the bone fractured images with. The x-ray images are pre processed and noisy data is removed which is followed by Random Forest Classifier where the Gabor , Gaussian , Median features are successfully extracted . After feature extraction the images are classified based on extracted feature . The performance of the proposed system is evaluated in terms of accuracy



Flow chart of proposed method

4. IMPLEMENTATION

4.1 Image Pre-processing

This stage includes the procedures that enhance the features of an input X-ray image so that the result image improves the performances of the following stages of the proposed model. The aim of pre-processing is an improvement of the image data that suppresses unwilling distortions or enhances some image features important for further processing, although geometric transformations of images are classified among pre-processing methods. We apply preprocessing techniques such as RGB to grayscale conversion and denoise the image by using the median filter in the first step.

4.2 Edge Detection

Edge Detection is a method of segmenting an image into regions of discontinuity. It is a widely used technique in digital image processing like Pattern recognition, image morphology, feature extraction. Edge detection allows users to observe the features of an image for a significant change in the gray level. This texture indicating the end of one region in the image and the beginning of another. It reduces the amount of data in an image and preserves the structural properties of an image. We use **Canny Edge Detection** method in this project. There are two general approaches to edge detection that are commonly used are: Gradient and Guassian. The edge detector method used in project is of Guassian family. After edge detection, the images are segmented using k-means clustering algorithm.

4.3 Feature Extraction

The main step in various preprocessing of an image is feature extraction. Random Forest Algorithm/Classifier is used for extraction of features and selection. In this project we have extracted **Gabor feature**, **Gaussian feature** is extracted. Random Forest is a supervised machine learning algorithm made up of decision trees. Random Forest is used for both classification and Feature extraction. Overall, Random Forest is accurate, efficient, and relatively quick to develop, making it an extremely handy tool for data professionals.

4.4 Classification

Classification is a step of data analysis to study a set of data and categorize them into a number of categories. Each category has its own characteristics and the data that belong to such category have the same properties of this category. Based on the Random Forest features, classifier classify the given image and returns the accuracy of the classification.

5. RESULT AND ANALYSIS

The results of pre-processing, edge detection is shown in Figure 2. Figure 2(a) shows input x-ray image of fractured femur bone. Figure 2(b) shows edge detected image and 2(c) shows processed output image. The Forest Random features are calculating for the segmented image and based on these features find whether fracture exists or not. The proposed method has been tested on set of X-ray/CT images consisting of fractured and normal images. The dataset consists of totally 100 images, 40 fractured images and 60 non-fractured images. After the feature extraction the images are classified into normal and fractured images based on Random Forest Classifiers features. The performance of the proposed system is evaluated in terms of accuracy.

The accuracy of the Random Forest Classifier is 99.31%.

Figure 2(a)

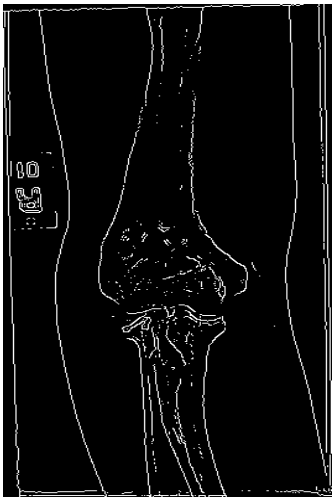
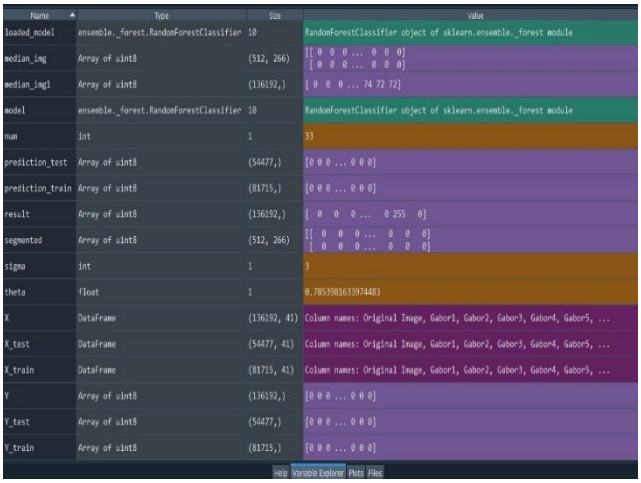


Figure 2(b)

Figure 2(c)

6. CONCLUSION

A computer based analysis technique for the detection of bone fracture using X-Ray images has been presented in this work. It starts from the pre-processing to remove the noise and to detect the edge by using Median Filter and Canny Edge Detection Techniques. After the detection, the method has been tested on a set of images and result have been evaluated based on Random Forest Classifier features. In future work, that specializes in alternative works like police work on smaller bone, articulation fractures, etc. could also be thought. Analysis shows that result obtained are satisfactory and accuracy of this method is 99.31%.



Name	Type	Size	Value
loaded_model	ensemble._forest.RandomForestClassifier	10	RandomForestClassifier object of sklearn.ensemble._forest module
median_img	Array of uint8	(512, 266)	[[0 0 0 ... 0 0 0] [0 0 0 ... 0 0 0]
median_img1	Array of uint8	(136192,)	[0 0 0 ... 74 72 72]
model	ensemble._forest.RandomForestClassifier	10	RandomForestClassifier object of sklearn.ensemble._forest module
num	int	1	33
prediction_test	Array of uint8	(54477,)	[0 0 0 ... 0 0 0]
prediction_train	Array of uint8	(81715,)	[0 0 0 ... 0 0 0]
result	Array of uint8	(136192,)	[0 0 0 ... 0 255 0]
segmented	Array of uint8	(512, 266)	[[0 0 0 ... 0 0 0] [0 0 0 ... 0 0 0]
sigma	int	1	3
theta	float	1	0.7853981633974483
X	DataFrame	(136192, 41)	Column names: Original Image, Gabor1, Gabor2, Gabor3, Gabor4, Gabor5, ...
X_test	DataFrame	(54477, 41)	Column names: Original Image, Gabor1, Gabor2, Gabor3, Gabor4, Gabor5, ...
X_train	DataFrame	(81715, 41)	Column names: Original Image, Gabor1, Gabor2, Gabor3, Gabor4, Gabor5, ...
Y	Array of uint8	(136192,)	[0 0 0 ... 0 0 0]
Y_test	Array of uint8	(54477,)	[0 0 0 ... 0 0 0]
Y_train	Array of uint8	(81715,)	[0 0 0 ... 0 0 0]

Help Variable Explorer Plots Files

Figure 3(a)

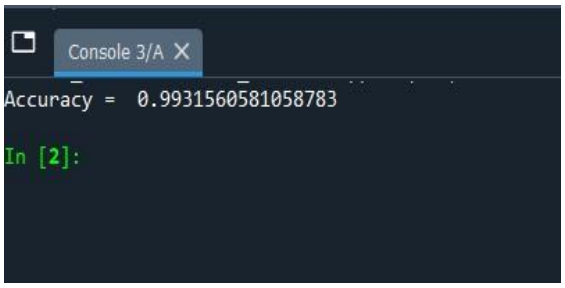


Figure 3(b)

7. REFERENCES

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