# Review of Various Fractal Detection Techniques in X-Ray Images

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## ABSTRACT
This paper represents the detection and segmentation of X-Ray bone fracture Detection using Edge detection algorithms. Edge detection is applied to find the fracture in a bone in the body (like Skull, Hand, and Leg, wrist, Bar room fracture, Chest, and Spine).Fracture is a medical situation in which there is a separation between two or more pieces of bones. The work of various researchers is discussed about the fractures present in X-Ray images and their detection techniques.

## General Terms
Methodology for Bone Fracture Detection

## Keywords
Image Segmentation, Edge Detection, Fracture X-Rays, SVM.

## 1. INTRODUCTION
Digital image processing is a field that can deal with the various digital images through the digital computers and it is widely used to develop the communication between the images, teleconferencing, digital libraries, image database, feature extraction, pattern recognition and other particular applied for the usage. For the implementation of remote sensing images like radar and ultrasound etc. extract as much information as from the images, and the techniques have been developed the image processing and analysis. Due to global collection of digital images, enhancement in the digital storage media, Image capturing devices like web cameras, printers, digital cameras, phones and rapid development in the internet are done. For rapid and efficient retrieval for visual information in the different fields of life such as medical, medicines, art, architecture, education, crime prevention, etc., digital image processing is used.

Due to the technological and software advancements, Medical image processing is gaining wide acceptance in healthcare industry. It plays an important role in disease diagnosis and improved patient care by helping medical practitioners during decision making. Human organs in digital forms are produced by several states of art equipments such as X-Ray, Single Photon Emission computed tomography, Mammography, Magnetic Resonance Imaging, Ultrasound, Endoscopy, Positron Emission Tomography, Fluoroscopy and Medical photography etc. X-Ray is non-invasive, painless and economical oldest approaches. An X-ray can make image of the bone in the body like wrist, knee, ankle, leg etc. A typical bone disorder may occur when bone cannot suffer outside force and a person, is unable to move that part of body is called Fracture. A fracture is cracks in bones and is defined as the breaking up of a continuous bone. As due to fracture, the patient can suffer from severe pain, dissatisfaction, expensive litigation, so the detection and correction treatment of should be done quickly. Detection of fracture can be done by passing x-ray emission through that part of body with the help of X-Ray machine. Medical imaging has become possible to approach the problem of automated diagnosis image with the advancement of computer processing capabilities. As the fracture cannot be seen by naked eyes, a radiologist can experience difficulties in reading and understanding the x-ray images due to the presence of noise or lack of proper illumination source. By building the system, one can hope the system to help the radiologist on detecting bones anomalies properly.

The various methods used by the fracture detection system involve the following steps: preprocessing, segmentation and fracture detection.

The Preprocessing enhances the x-ray input by removing the noise from the X-ray or other unwanted effects present in the X-ray by making it more suitable for segmentation. In the segmentation process, the separation of the fractured part is done from the body structure and identification of that part is done. The mostly used algorithm for segmentation is the Edge Detection, which separates the boundary of the object from the background. Then, the Fracture Detection which is a tough task verifies that the segmented image is fractured or not fractured. This Image processing use edge detection methods and SVM Classifier that expected to minimize error on detecting bone fracture.

## 2. GENERAL APPROCH TO CLASSIFICATION
Classification, also known as pattern recognition, recognition, Discriminant analysis, supervised pattern recognition learning or prediction, is a task that involves construction of a procedure that maps data into one of several predefined classes[1]. It applies a rule, a boundary or a function to the sample's attributes, in order to identify the classes. Classification can be applied to databases, text documents, web documents, web based text documents, medical images, cluster techniques and also used in MRI Scans etc. Classification is considered as a challenging field and contains more scope for research [1]. It is considered challenging because of the following reasons:

1) Information Overload and 2) Size and Dimension

- Information overload [1] –The information explosion era is overloaded with information and finding the required information is prohibitively expensive.
- Size and Dimension [1] – The information stored is very high, which in turn, increases the size of the database to be analyzed. Moreover, the databases have very high number of dimensions or features, which again pose challenges during classification.

A classification technique is an organized approach to classification of various models from an input training set and data set and this data set may contain the observations with the measurement on different variables [1]. For Example Decision Tree Classifiers(DT),Genetic Algorithms, Naive Bayes Classifiers ,Memory Based Reasoning, Rule-Based Classifiers, Ensemble classifiers, Neural Networks (NN), and Support Vector Machines (SVM), Nearest Neighbor classifier, etc. Each technique utilizes an algorithm to identify a model that gives the better relationship between the attribute set and class label of the input data and also generated tree overfits the training sets. The model generated by a learning algorithm should both fit the input data and correctly predict the class labels of records it has never seen before [1]. Therefore, a key objective of the learning algorithm is to build models with good generalization capability, i.e., models that accurately predict the class labels of previously unknown records. First, a training set consisting of records whose class labels are known must be provided. The training set is used to build a classification model, which is subsequently applied to the test set, which consists of records with unknown class labels [1].

## 3. RELATED WORKS

Now at present, a large amount of research has been started in image processing for medical field as per the specification of the diagnosis while, research in the field concerning X-ray images are less. The general segmentation techniques are edge based, region based, edge detection algorithms, watershed algorithms can be used.

There are general approaches for database like neural networks, rule based classifier and SVM. The main focus of this research is SVM.

Bielecki, A., Korkosz, M and Zielinski, B [2], [3], proposed an automated algorithm to compute the joint width in the x-ray images of the hand. Such a process is essential in age assessment as well as diagnosis of hand diseases (such as rheumatic arthritis) and their prognosis. It performs dilation of the image followed by a filtering step using Gauss function. Then a thinning procedure is used to define the skeleton of the hand and an analysis of the branches is performed to find the correct branches of the fingers. Based on these joints locations are detected and their widths are computed.

Mahendran and Baboo [4] presented a fusion classification technique for automatic detection of existence of fractures in the Tibia bone. The preprocessing steps of contrast adjustment, edge enhancement, noise removal and segmentation before extracting texture features. For the classification steps combining the results of three common classifiers, viz., feed forward back propagation Neural Networks (NN), Support Vector Machines (SVM) and Naive Bayes (NB), using a simple majority vote technique.

SP. Chokkalingam and K. Komathy [5] implemented a new scheme to diagnose the presence of rheumatoid arthritis by a series of image processing techniques which have been termed to be more effective than the other methods which perform the same task and hence provide a more effective approach in computer aided diagnosis. The system may be further enhanced by the improvement of the edge detection as well as finding a better segmentation technique. Gray level co- occurrence matrix (GLCM) features like Mean, Median, Energy, Correlation, Bone Mineral Density (BMD) and etc. After finding all the features it stores in the database. This dataset is trained with inflamed and non-inflamed values and with the help of neural network all the new images are checked properly for their status.

T.S.Howe et.al. [6] presented a method of hierarchical SVM classifier system for fracture detection in femur bones. To use hierarchical classifier, the problem is divided into smaller sub-problems. This is done in the SVM's kernel space instead of the feature space due to the complexity of the problem and the limited dataset. Each sub-problem is handled by an optimized SVM classifier and to ensure that the hierarchical performs well, lower-level SVMs should complement the performance of higher-level SVMs.

Y Jia and Y Jiang [7] presented a method of segmentation that find the outlines of fractured bones in an X-ray image of a patient's arm within the casting materials, and displays the alignment between the fractured bones. Geodesic active contour models with global constraints are applied to segment the bone region. A prior shape is collected and used as a global constraint. A maximum-likelihood function is derived to provide feedback for each evolving process. Results show that the method produces the outlines of the fractured bones on the low contrast X-ray images robustly and accurately. [8]

Martin Donnelley et.al. [9] developed a method of automatically detecting fractures in long bones. The edges are extracted from the x-ray image using a non-linear anisotropic diffusion method that smoothes the image without losing critical information about the boundary locations within the image. Then a modified Hough transform with automatic peak detection is used to determine parameters for the straight lines that best approximate the edges of the long bones. The parameters used to approximate the long bone edges are then used for centerline approximation, diaphysis segmentation and fracture detection in the segmented region.

C.Linda et.al [10] proposed a procedure for crack detection in X-ray image, which is based on the minimization of a fuzzy measure. The image histogram is divided into three fuzzy sub- sets using iterative approach to obtain subsets parameters. The obtained parameters were used as initial estimates and each pixel in the fuzzy regions were classified as belonging to one of the sub-sets by minimizing the fuzzy index. After segmenting the image into three regions, the background and skin regions are removed to detect the cracks in the bone region. A binary image thus obtained contains cavities or holes. A hole-filling step utilizing the morphological operation is then applied to the binary image to fill these spots and create a temporary image. The temporary image is subtracted by the original binary image to isolate the small pots. Morphological filtering functions (erosion followed by dilation) are then used to screen noise or undesirable spots using the iteration number as an operational parameter. The morphological operation can eliminate or maintain the spots on the image according to their area size.

## 4. SUMMARY

This paper surveyed various segmentation models that segment the bone structure and fractured region from an x-ray image. The steps used to extract the bone fracture from the x-ray image are Edge detection algorithms, preprocessing, feature extraction and SVM classifier in a serial fashion. Measure the performance of proposed algorithm in terms of metrices such as efficiency and elapsing time. For the future improvement implement another segmentation method to improve the fracture detection and also use another classifier.

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