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An Efficient Features Extraction of Bone Fracture Detection Using SVM

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Abstract

The main problem in human beings is Bone Fracture. The main reason behind this pain is due to high pressure applied on the bone. It occurs not only because of high pressure but also because of osteoporosis and bone cancer. Hence for bone fracture an accurate diagnosis is very important. In this paper the design of efficient features extraction of bone fraction detection using SVM is implemented. This will analyze the fracture in effective way. The main theme of this project is to develop an image processing efficiently for a quick and accurate classification of bone fractures based on the given information which we got from the x-ray / CT images. We get the Images of the fractured bone are from hospital. Total number of features are extracted using the SIFT Watershed transform based on gradient and homotopy modification to segment X-ray fracture images. Then the features consisted of region number, region area, region centroid and protuberant polygon of fracture image are extracted by marker processing and region props function. Finally this can be performed very accurately with effective output.

Key Words*: SVM (Support Vector Machine), SIFT(Scale Invariant Feature Transform), Bone Fraction Detection.*

I.INTRODUCTION

Bones are the solid organs in our body securing numerous significant organs like mind, heart, lungs and other inside pieces of the body [1]. The human body has 206 bones with various shapes, size, highlights and structures. The biggest bones in our body are the femur bones, which is at thigh and the littlest bones are the hear-able muscles which is at the ear. Bone break may occur because of a mishap or because of some high weight applied on the bones. There are various kinds of bone break like cross over, compound, imparted, winding, green stick in which it very well may be finished.

There are different kinds of clinical devices in imaging that are accessible to identify numerous sorts of variations from the norm like Computed Tomography(CT), X-beam, ultrasound, Magnetic Resonance Imaging (MRI),etc. Specialists will utilize all the more often the X-beams and CT in finding since they are the quickest route for the specialists to examine the wounds of bones and joints. Specialists by and large utilize x-beam to characterize if the bone is cracked or not, and the area where it is broken. The information utilized is DICOM pictures. In present clinics, pictures are secured in the standard DICOM (Digital Imaging and Communications in Medicine) design which includes text into the picture. Any opportunity to recover and show these pictures should pass by Picture Archives and Communication System [2-3].

Different broadly useful strategies and calculations have been proposed for picture division. Since there is no ideal answer for the picture division issue, these different procedures regularly are to be joined with

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area the information to tackle successfully and precisely about a picture division issue for a primary space. Edge location is a notable field all alone concerning picture handling. There are two distinct methodology to distinguish the edge location
.
They are gradient and Laplacian. Gradient method can be said as the first derivative and the Laplacian can be said as the second derivative. The broken bones should be moved to return them to the original position and orientation when the surgery is done. The problem with simulated bone repositioning is that the precision of the repositioning consequence is not simple to verify because each broken bone has an uneven shape and the border of each digitized model may not be sufficiently precise.

The machine learning is used to train and predict the autonomous system. Data training is carried out using a method of supervised machine learning. The overall method of the bone fracture classification includes mapping the information to one of several predefined classes. However, the classification methods present challenges that are due to the information overload size and data dimension. A classification method is described by building classification models as a systematic approach to processing input information. By evaluating texture characteristics, the fractured bone is recognized and categorized [4].

Edge identification technique is consequently a base of other division measure. The edges can be distinguished by edge identification some of the time gets disengaged. To lump an item from a picture one requirements a shut locale at any rate. A long research has been done in this area for which we got a best result in the field of interactive manually or fully automatic. The following is the brief overview about which many researchers have been done. The nesting structure which is described below is specific for one dimensional image but insignificantly specifies for high dimensional images. Finally this idea inspired many different authors to establish the truth for coarse-to-fine schemes for segmentation [5].

II. LITERATURE SURVEY

Many different algorithms were developed in detecting the bone fracture using image processing. V.Vijay kumar presented papers for filtering the noise. There are many noises presented in the CT scans or in the X-ray images because of the changed pixels in it or due to blur images. The noises presented in the images are mainly of Gaussian noise or salt or pepper noise. Based on the threshold values the surrounding pixels are being replaced by mean of the sum of pixels.

Alpha-trimmed mean, Wiener, Kmeans, bilateral and trilateral, are some of the algorithms which gives the lower mean absolute error and higher signal to noise ratio. Usually the noises like salt and pepper noises and the Gaussian noises are presented in the X-rays and CT scan images. By using 3x3 window which is contained with white and black pixels the k-fill algorithm are applied for removing the salt and pepper noise which are present in the images. This is proposed by the Al-khaffaf. By taking the noise presented images a poisson and a gaussion noises are taken so for estimating the parameters like component of poisson and mean and variance of the gaussion are presented in the images. Image enhancement and speckle reduction problems for filtering techniques are being addressed by the Zain and M.L .

Methods like wavelet and the curvelets transform are used in the feature extraction method which was proposed by the Chan and k.p. For achieving the higher accuracy rate the method called “Haar method” is being used. By comparing the other methods the Haar gives the higher accuracy results. For measuring the neck-shaft angle in the femur bone Tian proposed the system for detection of fracture in femur.

The works done by the Lim, Yap, Lum they used Gabor, Random feild, Marcov and the gradient intensity for extracting the features from the X-ray and CT scan images and they have fed to the Support vector

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Machine classifiers. By observation of this, while combining all the SVM classifiers the accuracy and sensitivity are being improved instead of using individual classifiers. By this the femur bones fractures can be detected by using the "hierarchical" SVM classifiers system.

Koenderink who suggested to study about iso-intensity contours how develop over scales and this step was investigated by the great authors Lifshitz and Pizer. Suddenly, this image intensity features changes over the scales, which is hard to find the coarse-scale image features to find for the better scales with the information based on the iso-intensity. Lindeberg had gone through the problem of linking local extreme and supportive points over scales, and suggested the representation of an image called as scale-space primary sketch that makes in detail with the relations between different scales of structures and also makes in detail explanation with the features of an image which are fixed for long ranges of scaling covering locally approximate scales.

Bergholm suggested discovering edges at coarse scales in space and then discovering back to the best scales with good choice for both localization scale and coarse detection scale. Gauch and Pizer had gone through the complementary problem of valleys and ridges at multiple scales and started developing an interactive image segmentation based on watersheds of multiple scale.

The benefit of using this watershed with application for a gradient map has also been established by Nielsenand and Olsen carried to their clinical use by vinclen who proposed a hyper stack to define probabilistic relations among structures of images at various scales .

The main theme of using stable image structures over sales has been developed by Ahujaand and his co-workers into an automated form. In recent days the ideas for multiple scale image segmentation through the linking process over scale image segmentation through the linking process by Florack, Kuijper and Rue who associated the structure defeated in scale –space above a noise with minimum threshold into an object tree which is extent to multiple scales and related to a kind of features in signal which is original .Features which are extracted accurately re-established using a method of iterative conjugate matrix gradient.

Bone fracture diagnosis using machine learning and image processing are very popular. In the past several works have been carried out to diagnose the fractured bone. Myintet have used an X-ray image to detect fractures on the leg. Canny algorithm has been used for the segmentation of the image. The texture feature Hough transforms is applied to detect fractures in the bone. A transferable method has been provided by Kim et al. In the many prospective applications towards medical imaging, their method can be applied.

Vegiet have used basic image processing techniques to remove noise, detect edge and extraction of the features from an image. Finally, classification techniques are used to classify fractures and healthy bone. They have developed a tool on the MATLAB and implemented an algorithm with a classification accuracy of 85%. The methods of information processing are data-driven and are used inherently in radiology. In this field, deep learning can be used as a strong instrument for imaging. The radiologist used the methods of deep learning in this job and the technique gives more precise interpretations.

Tibia bone fractures can be automatically detected by using fusion classification technique which was proposed by the Mahendran. The segmentation is the next step in the process which was proposed by the Chai which was based on the GLCM method. It is used to segment the X-ray or the CT scan image of any part in the body and separates the bone regions and the soft tissue regions. The pre-processing techniques are binary conversion, and edge detection and the K-means segmentation and GLCM methods are used in

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the feature extraction process. Automatic segmentation method for X-rays and CT scan images was proposed by the Hao.

At first the edges of the images will start detecting automatically determine the region of the interest. At last the image is segmented and only the bones are being extracted. The automated algorithm was developed for computing the joint width in the X-rays/ CT scan images which was proposed by the Bielecki. In this work, using the image processing the automatic classification of bone fracture information is been gained for the X-rays/CT scan images with a higher accuracy rate and in this all types of bone fractures can detected.

III. FEATURES EXTRACTION OF BONE FRACTURE DETECTION USING SVM

The below figure (1) shows the algorithm for features extraction of bone fraction detection using SVM. The morphological segmentation algorithm of watershed transform based on the operators has been successfully applied to many fields including medical and military. Its advantage is the robustness, that is to say, the segmentation result is independent of the shape or placement of the zones of interest. But, it often results in over-segmentation to use watershed transform directly on an original image.

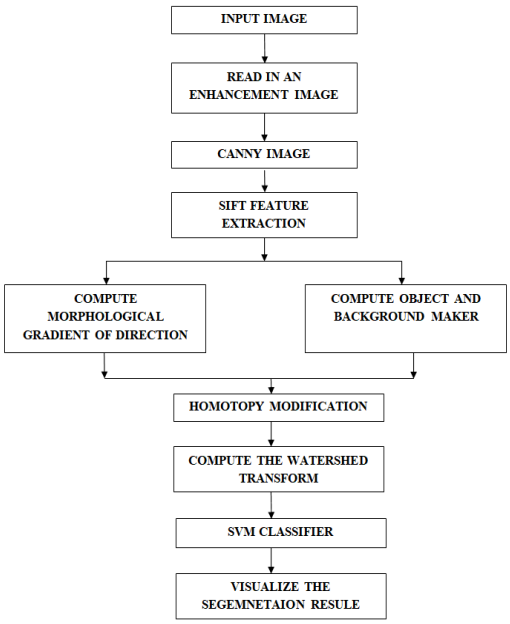

Fig. 1: THE ALGORITHM FOR FEATURES EXTRACTION OF BONE FRACTION DETECTION USING SVM

To section X-beam pictures of human body break that having low differentiation and sharpness, an improved marker controlled watershed change is introduced in this paper. Edge extricating of X-beam muscular picture is improved in the premise of marker-controlled watershed calculation, and basically present morphological heading inclination calculation and marker choice calculation.

As indicated by qualities of morphological organizing components, the paper proposed utilization of the four headings of the straight organizing components computing bearing inclination, so the agent pace of slope data likewise have directional. Marker determination calculation chooses the item markers under dim distinction. The morphological directional slope is altered by methods for object markers and foundation markers that called as homotopy change.

Extraction of Image highlights is a significant advance for grouping of an Image. Better component extraction improves classifier to give results. The exhibition of the classifier is mostly relied on how well

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the highlights are separated. Numerous sorts of highlights can be extricated from a picture like shading highlights and the edges. Here in this, SIFT(Scale Invariant Feature Transform) include extraction technique is proposed.

Each point in SIFT-based component extraction and coordinating is depicted as a 128-measurement vector. The all out number of highlights are removed utilizing the SIFT and further Euclidean distance is determined from in the middle of the separated highlights and is then orchestrated in a climbing request dependent on their distance. Presently, in the wake of estimating the Euclidean distance, In order to test whether the proportion between the most minimal and second-least is not exactly the threshold (0.7) taken dependent on the type of trail and mistake.

Classification is a method of data analysis that is used to study a set of data and categorizing them into different categories. Each and every category has its own characteristics and the data that belonging to such category has similar properties of that category. In this method, different types of classifiers are used some of them are Decision tree, Neural network and Meta classifier.

Segmentation is the phenomenon of dividing the image into different regions that are homogeneous with respect to certain features like colour, intensity etc. In this project we used K-mean clustering technique. The purpose of K-mean clustering is to minimize the absolute difference function. In this technique the absolute difference between pixel and cluster center has been measured or the distance ‘s’ squared. This difference is typically depends on pixel intensity, location, texture and colour. Based on the initial values of cluster and the value of K, the solution quality depends. After doing the segmentation process the area of fracture and the image are cropped with some limitations

IV. RESULTS

Data Set: The data set has been collected from the open repository of IIST, Shibpur. A compilation of publicly available/accessible medical images is presented. It contains Healthy X-Ray images, Bone X-ray Images (Fractured Bone) and Bone X- ray Images (Cancerous Bone).

In the present study MATLAB 16a, 8GB RAM and i7 processor have been used to perform the experiment. Images are collected from different source due to which it contains noise. It is necessary to resize the image and remove noise. The texture feature extracted from the GLCM matrix depends on the size of pixels. In the present study, it found that the texture feature extracted from a larger image reduces the accuracy.

In figure (2), x-axis contains 60 test images of size 25x25 pixels. Image ranges from 1 to 41 are of fracture bone and image ranges from 42 to 60 are of as healthy bone. The size of image affects the accuracy of the automated system. In fracture bone test datasets out of 41 facture images 2 images are false negative and out of 19 healthy images 3 are a false positive.

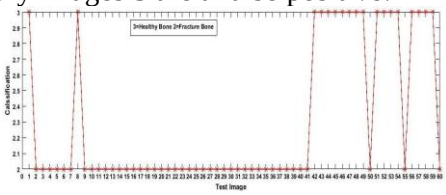

Fig. 2: Test result of data set of size 25x25 pixels

In figure (3), x-axis contains 60 test images of size 500x500 pixels. In the fracture bone test data sets out of 41 facture images 15 images are false positive and out of 19 non fracture images 8 are false positive.

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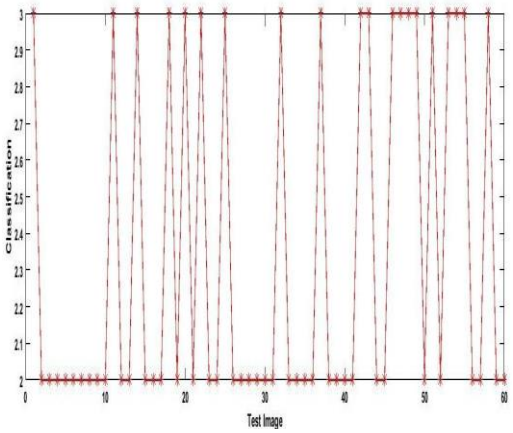

Fig. 3: Test result of data set of size 500x500 pixels

In the proposed study, we have compared the performance of the two machine learning techniques SVM and random forest on the selected feature. The performance is shown in the table1.

Table1: Comparison of the SVM and Random Forest Machine learning algorithm

Measure	Random Forest	SVM
Accuracy	71.66	91.66
F1 Score	74.62	93.98
Precision	96.15	92.86
Recall	60.97	95.12

The accuracy, recall, and f1-score of the SVM model are much better than the Random forest. The precision of the random forest algorithm is better than the SVM model. Indeed the precision of the random forest is better but overall the performance of the SVM is better. Therefore, we have selected SVM for the proposed approach.

Due to accidents and many illnesses, instances of bone fracture are growing day by day. It is therefore essential to develop a computer-based system capable of detecting the bone fracture. In the biomedical field, image processing, machine learning, and computer vision are common. There are noises in the images. Appropriate noise removal filter is implemented. In the present study, noise is removed by applying a median filter of size 3x3. .

In the fracture bone the distribution of pixel is unequal. The lower values of a pixel can be seen on the fractured part. An income inequality concept of economics, which is used to find the distribution of the data, is useful to find the pixel distribution in the image, value close to zero indicates the equal distribution and close to 1 indicates maximum un equal distribution.

The probability of occurrence of the gray level pixels defines the entropy. The value of entropy depends on the quantity of the gray level pixels. The skewness measures the asymmetry in the image.

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Table 2. Result comparison of test datasets

Measure	Feature Vector (Contrast, Homogeneity, Correlation, Energy)	Feature Vector Energy, Entropy, Skewness and Gini Index)
Accuracy	73.33	91.66
F1 Score	80.49	93.98
Precision	82.98	92.86
Recall	82.98	95.12

V. CONCLUSION

Hence, in this paper the design of efficient features extraction of bone fraction detection using SVM was implemented. SIFT Plays very important role in entire system. Watershed transform will transform the images successfully. SVM classifier also classified the images after transformation. The obtained image is segmented and output image is obtained. At last it can say that the proposed design gives effective results.

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