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Advanced Computerized Classification of X-Ray Images Using CNN

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Abstract:

Medical Imaging is an essential part of today's healthcare system for performing non-invasive diagnostic procedures. It involves creation of visual and functional representations of the interior of the human body and organs for clinical analysis. Its different types include: X-ray based methods, such as conventional X-ray, computed tomography (CT) and mammography; molecular imaging, magnetic resonance imaging (MRI) and ultrasound (US) imaging. Medical image segmentation, as an application of image segmentation, is to extract anatomical structures from medical images. In this process, existing methods for medical image segmentation are reviewed and then proposed methods like Thresholding, Edge and CNN to characterize the bone texture and then classifying it. More specifically, we propose a method to extend the conventional method by using the Convolution Neural Network. A texture classification framework is proposed based on CNN which provides the better classification results. Hence it shows the results as fracture or non fracture. In this review, the basics of deep learning methods are discussed along with an overview of successful implementations involving image segmentation for different medical applications. Finally, some research issues are highlighted and the future need for further improvements is pointed out.

Keywords: **CNN (Convolution Neural Network),CT Scan, MRI,US, Fractures, Computerized**.

1.INTRODUCTION:

There are 700,000 of rheumatoid arthritis (RA) patients in Japan, and the number of patients is increased by 30,000 annually. The RA damages joints, the joint destruction and joint deformity causes the pain, and reduces the joint function. The prognosis is improved by early treatment, but it is necessary to accurately evaluate the degree of RA progression and to take appropriate treatment. The hand or foot X-ray images are used for the RA diagnosis. The modified Total Sharp (mTS) score evaluates the erosion and joint space narrowing (JSN) on 32 hand joints and 12 foot joints. The 5 grades of erosion score and 4 grades of JSN score are manually given for each joint by ortho-paedicians. The RA progression is calculated by the sum of the calculated scores. However, X-ray images

should be taken several times a year for proper assessment, and the mTS score measurement takes huge labor and is time-consuming method because there are many evaluation points and it is difficult to give the score. Also, the mTS score is subjective as it is scored manually by orthopaedicians. Thus, it requires an automated mTS score calculation system based on X-ray image analysis. The fully automated mTS score calculation system requires an automated finger joint detection method. Ref. [6] proposes a deep learning based finger joint detection method. It is applied to children whose finger joint is growing, and cannot be applied RA patients directly. Other method is based on X-ray image intensity difference in the joint space [2]. It cannot analyze severe RA patients because their collapsed finger joint has no joint space. The mTS score evaluates the erosion score and JSN score for each finger joints. Ref. [2] automatically estimates the JSN score of the mild RA patient. The method cannot evaluate the JSN score of severe RA patient whose joint does not have enough joint space. Previously, we proposed a fully automated finger joint detection method and mTS score estimation method for the mild-tosevere RA patients using hand X-ray image [1]. However, the performance of the method has not been evaluated sufficiently. This paper aims to evaluate the performance of a fully automated finger joint detection and mTS score estimation method. In addition, we investigate a possibility of improving the performance by artificially rotating and gamma correction of the training image. 8We also evaluate details of estimated scores, and total mTS in the sake of clinical application.

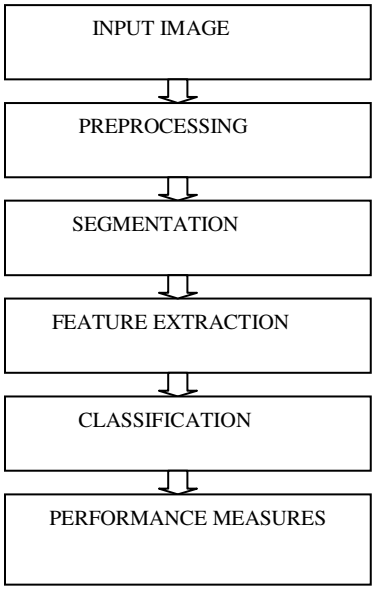

Figure:1 Module description

2. LITERATURE REVIEW:

It is very crucial problem for the doctors for determining fractures in a bone

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In 2019, Basha, C. Z., Simha, G. K. J., & Krishna, Y. V. An efficient and robust fracture detection in femur bones. [3]Sometimes it become very important in finding hairline fractures for surgery. Development in Medical imaging is growing very rapidly>It is very important to automate the system of fracture detection to take faster decisions. Images can be in RGB or gray or Binary.PSNR value is used to check the noise in the image.

In 2018, Basha, C. Z., Sricharan, K. M., Dheeraj, C. K., & Ramya Sri, R. A study on wavelet transform using image analysis. [4]Filtering is to be applied in order to remove the noise from the image. There are many filtering techniques that are there like mean, median, high boost filtering. Segmentation is done in order to cluster the image.FCM algorithm is suited for Clustering

but there re certain drawbacks with the fuzzy c means clustering due to its membership

In 2005, Rafeal. C. Gonzalez & Woods.[7] Features are to be extracted from the region of interest to provide the input to the classifiers. Features can be of any kind like texture features can be a color, shape, size.

In 2011, Othman, M. F. B., Abdullah, N. B., & Kamal, N. F. B. MRI brain classification using support vector machine. [5]Proper selection of classifier is very important to give more accurate results. There are any classifiers are available for training and testing purposes.

3. METHODOLOGY:

In this paper, consists the following methods to classify the Bone fracture with the help of CNN algorithm.

- Input Image
- Preprocessing
- Segmentation
- Feature Extraction
- Classification
- Performance Measures

3.1 INPUT IMAGE:

The first stage of our automated skin lesion analysis system is image acquisition. This stage is essential for the rest of the system; hence, if the image is not acquired satisfactorily, then the remaining components of the system may not be achievable, or the results will not be reasonable, even with the aid of some form of image enhancement. In order to capture high quality images, the iPhone 5S camera is used, equipped with 8 megapixels and 1.5 pixels. An image is a rectangular array of values (pixels). Each pixel represents the measurement of some property of a scene measured over a finite area. The property could be many things, but we usually measure either the average brightness (one value) or the bright nesses of the image filtered through red, green and blue filters (three values). The values are normally represented by an eight bit integer, giving a range of 256 levels of brightness. We talk about the resolution of an image: this is defined by the number of pixels and number of brightness values. Read an image into the workspace, using the “imread” command. The example reads one of the sample images included with the toolbox, an image, and stores it in an array named I . “imread” infers from the file that the graphics file format is Tagged Image File Format (TIFF). Display the image, using the “imshow” function. You can also view an image in the Image Viewer app. The “imtool” function opens the Image Viewer app which presents an integrated environment for displaying images and performing some common image processing tasks. The Image Viewer app provides all the image display capabilities of “imshow” but also provides access to several other tools for navigating and exploring images, such as scroll bars, the Pixel Region tool, Image Information tool, and the Contrast Adjustment tool.

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3.2 PREPROCESSING:

3.2.1 IMAGE RESIZE:

In computer graphics and digital imaging, image scaling refers to the resizing of a digital image. In video technology, the magnification of digital material is known as upscaling or resolution enhancement.

• When scaling a vector graphic image, the graphic primitives that make up the image can be scaled using geometric transformations, with no loss of image quality. When scaling a raster graphics image, a new image with a higher or lower number of pixels must be generated.

• In the case of decreasing the pixel number (scaling down) this usually results in a visible quality loss.

• From the standpoint of digital signal processing, the scaling of raster graphics is a two dimensional example of sample rate conversion, the conversion of a discrete signal from a sampling rate (in this case the local sampling rate) to another.

3.3 SEGMENTATION:

In image processing, segmentation is often the first step to pre-process images to extract objects of interest for further analysis. Segmentation techniques can be generally categorized into two frameworks, edge-based and region based approaches. As a segmentation technique to segment an image for further processing such as feature analysis and quantification. Otsu's method searches for a threshold that minimizes the intra-class variances of the segmented image and can achieve good results when the histogram of the original image has two distinct peaks, one belongs to the background, and the other belongs to the foreground or the signal. The Otsu's threshold is found by searching across the whole range of the pixel values of the image until the intra-class variances reach their minimum. As it is defined, the threshold determined by Otsu's method is more profoundly determined by the class that has the larger variance, be it the background or the foreground. As such, Otsu's method may create suboptimal results when the histogram of the image has more than two peaks or if one of the classes has a large variance.

3.4 FEATURE EXTRACTION:

A pattern consists of multiple instances of a feature. Select a pattern type and define dimensions, placement points, or a fill area and shape to place the pattern members.

• The result of the operation is a feature pattern.

• When you pattern this feature pattern, the result is a feature pattern.

• You cannot pattern either a group pattern or a feature pattern.

• In machine learning, pattern recognition and in image processing, feature extraction starts from an initial set of measured data and builds derived values (features) intended to be informative and non-redundant, facilitating the subsequent learning and generalization 40steps, and in some cases leading to better human interpretations. Feature extraction is related to dimensionality reduction.

•Steps involved in the local descriptor feature detection is,

1.Find the interest points.

2.Consider the region around each key-point.

3.Compute a local descriptor from the region and normalize the feature.
4. Match local descriptors.

3.5 CLASSIFICATION:

The convolutional neural network (CNN) is a class of deep learning neural networks. CNNs represent a huge breakthrough in image recognition. They're most commonly used to analyze visual imagery and are frequently working behind the scenes in image classification. A CNN convolves (not convolutes…) learned features with input data and uses 2D convolutional layers. This means that this type of network is ideal for processing 2D images. Compared to other image classification algorithms, CNNs actually use very little preprocessing. This means that they can learn the filters that have to be hand-made in other algorithms. CNNs can be used in tons of applications from image and video recognition, image classification, and recommender systems to natural language processing and medical image analysis.

3.6 PERFORMANCE MEASURES:

• Sensitivity and specificity are statistical measures of the performance of a binary classification test, also known in statistics as classification function.
• Sensitivity (also called the true positive rate, the recall, or probability of detection[1] in some fields) measures the proportion of positives that are correctly identified as such (i.e. the percentage of sick people who are correctly identified as having the condition).
• Specificity (also called the true negative rate) measures the proportion of negatives that are correctly identified as such (i.e., the percentage of healthy people who are correctly identified as not having the condition)

4. RESULTS AND DISCUSSION:

Here the comparative results of Accuracy, Sensitivity, Specificity of X-ray images where BPNN gives and accuracy results of 89, sensitivity results of 87, specificity results of 88 where as the results of CNN gives and accuracy of 91, sensitivity of 90, specificity of 91 .here results are compared with BPNN and CNN and CNN gave better results compared BPNN. Here results also compared with methods proposed till date and the proposed work works far better than any other work. the graphical results of obtained results comparison. Confusion matrix is used for getting accuracy, sensitivity, specificity.

$$Sensitivity=TP/TP+FN.$$

$$Specificity=TN/TN+TP.$$

$$Accuracy=TP+TN/TP+FP+TN+FN.$$

	Accuracy	Sensitivity	Specificity
BPNN	89	87	88
CNN	91	90	91

Table.1Comparative results of BPNN, CNN

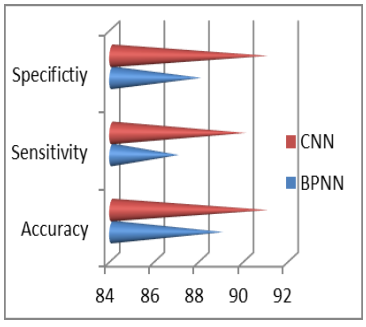

Figure:2 Graphical representation of comparison of results.

5. CONCLUSION:

In this paper, a comprehensive survey on crack detection of bone using various techniques is completed. The digital image processing systems are exceptionally useful for examining the deformities of grouped surfaces by applying different techniques like Edge detection, image segmentation, image feature extraction, image enhancement, fiber Bragg grating sensors, image classification, strain methodology, digital image correlation Every different technique has its own benefits and negative marks. From this audit, it alright could also be comprehended that a couple of techniques gives more accurate result and error rate is additionally reduced.

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