APPLYING DCT AND DWT COMBINATION IN IMAGE SEGMENTATION FOR DETECTION OF BENIGN AND MALIGNANT TUMORS

Mr. Santosh V Vishwakarma, Prof. B. G. Hogade

M.E. Student of Shree L.R.Tiwari college of Engineering Mira road, Professor at Terna college of Engineering, Nerul
Electronics and Telecommunication,
Shree L.R.Tiwari college of Engineering, Mira road, Nallasopara, Palghar, India

Abstract: it is very important to detect brain tumor from MRI images in automated diagnosis of brain tumor images. Therefore it is important to have an algorithm for the treatment of MRI images to detect a tumor. We developed a new approach by using the treatment of image in frequency domain who classifies accurately the brain tumor from the MRI image. We have used the combination of DCT and DWT with SVM to classify tumors. We could classify MRI images automatically in benign and malignant tumors.

***Index Terms* - Discrete cosine transform, discrete wavelet transform, Support vector machine, Tumor detection.**

I. Introduction

The cancer is a disease from which it is difficult to recover if not diagnosed at an earlier stage and even be fatal. As a result, to recognize a tumor at an earlier stage can be easier for the treatment, and to save somebody from death. The objective of the treatment using the biomedical image is that the image is first improved and segmented to help the doctors. In this paper, we performed automated tumor detection. In the proposed algorithm firstly histogram equalization was carried on magnetic resonance image (MRI) which is a grayscale image. An efficient frequency domain method was used for the segmentation of the image. The extraction of characteristics was performed on segmented images by using discrete cosine transform (DCT) and discrete wavelet transform (DWT). The tumor was recognized finally by using SVM (Support Vector Machine).

II. RESEARCH METHODOLOGY

2.1 RESEARCH

Recent literature on tumor detection lack accuracy and mostly considers one method at a time to improve the speed of detection. Paper focuses on the accuracy rather than speed of detection. The article "segmentation of images for the detection of benign and malignant tumors" offers the method of segmentation to separate brain MRI images for the detection of the outlines of the tumourous structure. Especially, the brain images MRI can be improved by using segmentation of the images by Otsu's method. Otsu`s allows us to recognize a threshold adapted to segment the part of the tumor image after the detection of the threshold [1].

The most complicated structure of the human body is the brain, and the segmentation of the brain from an image must be accurate. But to do that, it is very difficult because the form is not regular and the investigation is difficult. Also, the segmentation is not easy, what uses a lot of time and a hand - of skilled workers are necessary. The treatment of image real-time requires treatment on big data of pixels of the image in stipulated time. A reconfigurable device such as FPGA can be a programme to be treated on big data of the image and the time of treatment requested on the image can be reduced by displaying techniques of parallelism in the algorithm. Different approaches based on the segmentation were examined and compared here to extract the tumor of all the images of the brain. Different approaches to detection of outlines were also examined and compared [2].

The magnetic resonance images (MRI) plays a central role in the pre-surgical evaluation of the patients with Intractable Epilepsy. Researchers on the optimum process of segmentation from brain MRI images were performed. Methods such as k means and fuzzy c means were used for the segmentation of white matter, grey matter and of cerebrospinal fluid tissues. Technology of clustering is an attraction of neighborhood, which depends on the relating site and on the characteristics of the neighboring pixels. FCM is more efficient for the segment of the vague limit region, but major disadvantage is that there is not of a better way of determining the value of centroid of the cluster and the centers of initial cluster, principally. FCM is an algorithm of optimization of local research, he will converge on the point local minimum and this effect of regrouping would have a bigger impact if initial stocks of the centroid are not correct [3].

The article "an automatic system of extraction of brain tumors using different methods of segmentation" presents algorithms for the extraction of brain tumor from MRI images by using four different methods: Otsu`s segmentation, K-means, fuzzy-c means segmentation and finally thresholding. The main objective of this article is to develop a system for the detection of brain tumors entirely automated capable of recognizing and extracting the tumor from MRI images of the brain. In this article, a system of detection of tumor used automated, sophisticated method but introduced with very good precision with an increased time of calculation [4].

There are more than 120 types of brain tumors. It therefore became more essential to recognize and to cure correctly these types of tumors and these tumors are generally diagnosed by experts who can reside in different places. The television-radiology is the process of electronic transmission of radiological images from a place to other one for aims of interpretation and of consultation. Since the transmitted image has very precious information, the technology of habitual compression cannot be applied. In this article, we offer a new technology of iterative thresholding and profitable for the segmentation of brain tumor and to separate it from the non-region of interest. The region not of interest is compressed by using the simple improved coding Differential pulse code modulation (DPCM) and Huffman and the uncompressed tumor along with the compressed non-ROI [5].

A quantitative technology to extract different attributes of MRI images is discussed. A method known as hybrid segmentation combining the segmentation of threshold, the watershed segmentation, the detection of edge and the morphological operators is jointly considered. This combined technology is tested with images scanned by MRI of human brains to recognize a tumor. Precise size and location of tumor are recognized by using the technology of current hybrid segmentation [6].

A computer-based method to define the tumorous region in the brain by using MRI images is introduced. A classification of the brain in the healthy brain or a brain having a tumor is first made, which is then followed by an additional classification in benign or malignant tumor. Algorithm incorporates stages for the pretreatment, the segmentation of image, extraction of characteristics and classification of images by using techniques of network of neurons. Finally, the tumorous region is specified by technology of region of interest as stage of confirmation [7].

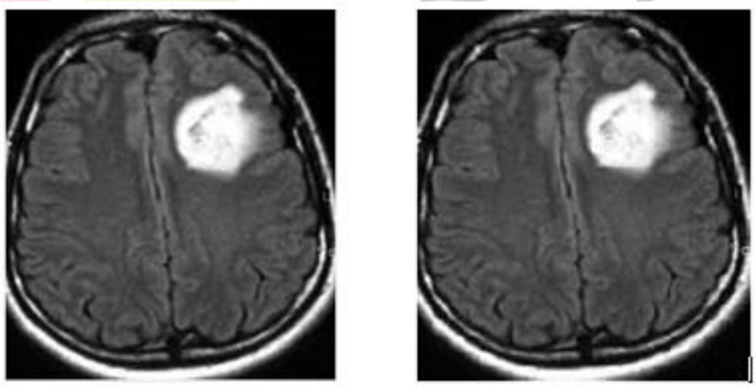
The article "detection of a brain tumor of MRI images by using segmentation and SVM" offers an adaptive detection of brain tumor, the treatment of image is used in the medical tools for the detection of tumors, and only MRI images are not capable of identifying the tumorous region. In this document, the segmentation k-means with pretreatment of the image was used. Which contains the denoising by median filter and the masking of the skull is used. Also the labeling of object for more detailed information of the tumorous region had been discussed. To make this system adaptive SVM (support vector machine), SVM was used in a supervised way, that will allow to create and to support the model for a future use [8].

2.2 METHODOLOGY

The proposed algorithm steps are as follows: the image was read in bmp, jpg, tif; gif, png picture format. Size was computed of the image. In case image was found to be an color image it was converted to grayscale image. Next, image histogram stretching and equalization was performed. Problem of non-uniform illumination was removed using adaptive thresholding. Image was then resized into 512x512 pixel image. Image was clustered using 8x8 masks and DCT was computed on the 8x8 smaller images. First 9 elements were selected from 64 element DCT matrix. Inverse DCT was then applied to generate orignal image with reduced information. Image was then converted into smaller block of 200x200 pixels. The image was then binarized using ostus algorithm. The cluster images are converted to lab images. Lab images were further clustered using k-means clustering and Euclidian distance decoding. Images were further segmented using cluster number found in kmeans clustering. Sudo color assigned to tumor was very different to that of the background and hence tumor was found in cluster 1. Original RGB image was converted to 2d matrix and dubechi. PCA was then applied to the wavelet components. Contrast, Correlation, Energy, Homogeneity, Mean Standard deviation, Entropy and RMS, Variance, Smoothness, Kurtosis, Skewness was computer. Support vector machine (SVM) was used to classify tumor. For training purpose 60 images were used. SVM with Radial Basis Function (RBF) was used to compute type of tumor on 80 positive tumor test images. Maximum % of images was used to cross-validate the results and compute the accuracy.

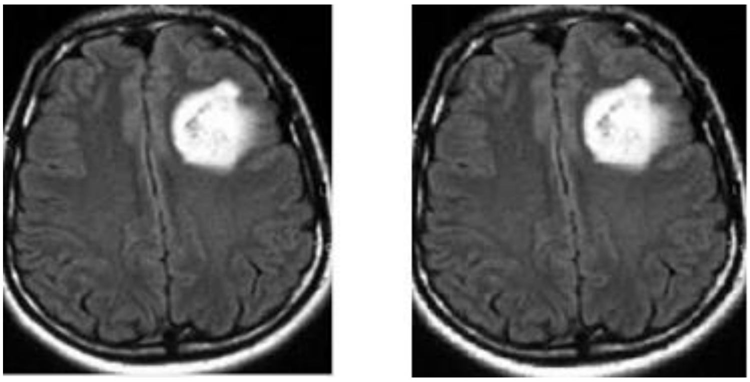
III. RESULTS AND DISCUSSION

Out of 80 images tested 28 benign images, and 42 malignant and 10 healthy images were used. Step by step output images are as shown below:



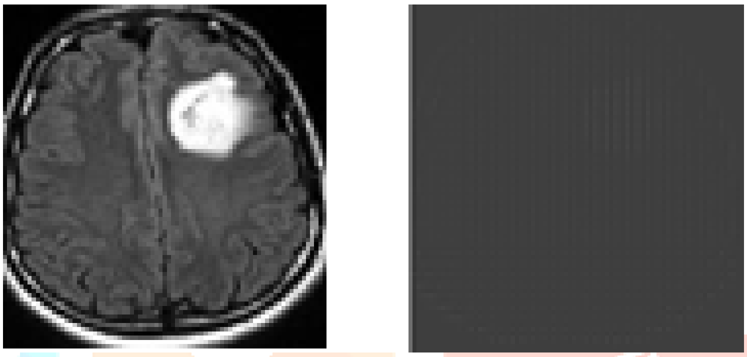
(a) (b)

Figure1: (a) Original MRI image (b) grayscale image



(a) (b)

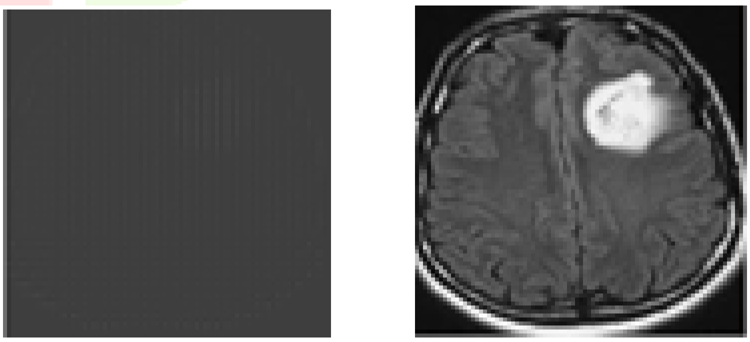
Figure2: (a) grayscale image (b) Contrast Stretched image



(a) (b)

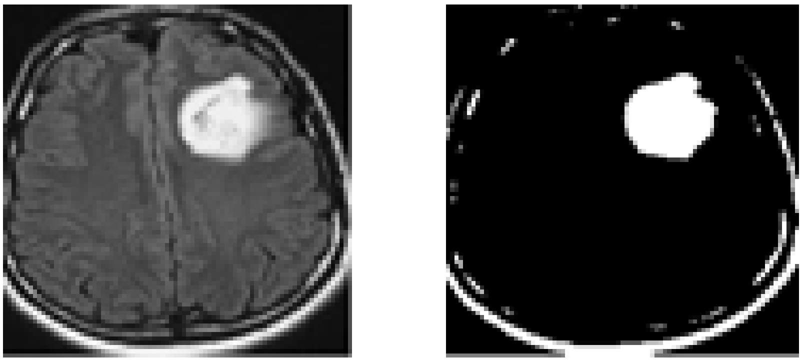
Figure3: (a) Contrast Stretched image (b) DCT image

Figure1 shows Original image in RGB colour space and corresponding grey scale image. The original image was obtained using ECLOS scan machine with 512*512 resolutions. Figure 2 shows contrast stretch output image when compared to grayscale image. Figure 3 shows DCT output image. Figure 4 shows reconstructed image after considering only first component of DCT matrix. It can be seen that original MRI image and reconstructed MRI images are very similar. Figure 5 shows output after OTSU's thresholding algorithm. Figure 6 shows tumor segmented and corresponding original MRI image. Out of 42 malignant only one was misclassified of 28 benign image and all 10 healthy images the results were 100% accurate hence overall algorithm accuracy was 98.75%



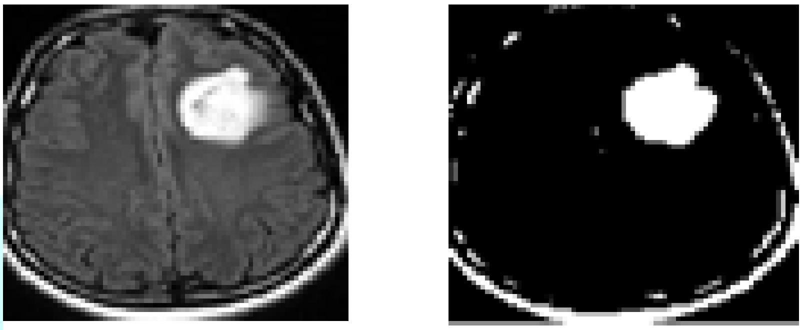
(a) (b)

Figure4: (a) DCT image (b) Reconstructed image



(a) (b)

Figure5: (a) Reconstructed image (b) Otsu's Threshold image



(a) (b)

Figure6: (a) Original MRI image (b) Segmented Tumor image

The combination of DCT and DWT for tumor detection gives better accuracy as compared with the isolated DCT and DWT technique for tumor detection. The SVM classifier is very fast and produces results with execution time less than second. The overall execution time of our algorithm is less than 10 seconds which is much faster than MRI processing time of 1 minute.

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