International Journal of Engineering Research and Development
e-ISSN: 2278-067X, **p**-ISSN: 2278-800X, www.ijerd.com
Volume 6, Issue 9 (April 2013), PP. 37-42

An Improved Implementation for Brain Tumor Detection on CT scanImages

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Abstract:- CT scan imaging has been popularly applied for the diagnosis of brain tumor and brain cyst. CT scan image alleviate the difficulties of physicians in order to visualize affected regions. However sometime it is difficult to visualize very minute regions of tumors and cysts and differentiate between them and sometime they are wrongly predicted due to very minute appearance in the CT scan image especially in early growing stages of brain tumor and cysts which are scanned by CT imaging but cannot be predicted or easily visualized by physician or health care professionals which results in delay in detection or wrong treatment of patient even if the patient have reported in early to the hospitals. Hence it becomes very important and necessary to develop such techniques to resolve this problem.

Keywords:- CT scan: (computerized tomography scan Images with (brain tumor, cyst), Edge Detection, Segmentation etc.

I. INTRODUCTION

CT scan is Computed Tomography, also known as computed axial tomography, or CAT scan, medical technology that uses X rays and computers to produce 3D images of the human body. Unlike X rays, which highlight dense body parts, such as bones, CT provides a views of the body's soft tissues, including blood vessels, muscle tissue, and organs, such as the brain. While conventional X rays provide flat two-dimensional images, CT images depict a cross-section of the body. A CT scan is used to define normal and abnormal structures in the body and/or assist in procedures by helping to accurately guide the placement of instruments or treatments. CT scan imaging is widely used in detection of brain tumor, cyst, and blood clots etc from last four decades (1970). CT scan is one of the high levels of medical imaging system but generally it generates a very complicated output that makes the diagnostic procedure of understanding more complicated and difficult for medical professional other then radiologist which increases the dependency of surgeons on radiologist reports.CT scan process are highly prone to artifacts and noises which causes a unwanted disturbance in tomography generated by machine and to overcome such problems CT scan professionals cannot use high range of x-ray above a safe level mentioned in medical authorities guidelines because high intensity exposure to x-ray can cause a serious problem to patients . That is why CT scans output generation process is accompanying by so many image processing steps and so many new processing techniques, methods are developed as well as adopted successfully in recent years. Clear detection of minute brain tumor and cyst regions in CT scan images is one of thebasic issues in imaging because if this kind problem is arises in CT scan then medical professionals either switch for contrast CT or for higher imaging like MRI (magnetic resonance imaging), PET (positron emission tomography), SPECT (Single Photo Emission Computed Tomography) which significantly increases the cost of medicalimaging. In order to reduce the cost of medical imaging and complexity of CT scan imagingthe representation of CT scan output has to be clear as well as prominent suspectedregion in CT images so that the reliability of doctors on CT scan could be increased. Now the challenges lies how to make CT imaging more clear and prominent for minute brain tumor and cyst detection and increase the reliability of surgeons on CT scan.Addressing this concept a framework to detection of minute brain tumor and cyst in CT scan images is proposed in work. This detection technique involves Pixel by Pixel analysis under whichsegmentation, edgedetection, feature extraction has been done.

II. IDENTIFY NOISY PIXEL

Since, the pixels are portioned into four categories, These are the known as foreground’s pixels, the background’s pixels, the isolated noise pixels and the noise points attached to image’s margins.
For 8 bit images, if a pixel is corrupted, it is replaced by positive and negative impulse values. For example, the noisy pixel takes ‘0’ for a negative impulse and ‘255’ for a positive impulse.

Let x(i,j) be the pixel value on the position (i,j) in the input image G, if x(i,j) = 0 or 255, then we set C(i,j) = 1 .Otherwise C(i,j) = pixel value.

III. METHODOLOGY

In this paper we have developed technique of minute brain tumor and cyst detection in CT scan images using edge detection and segmentation based on pixel by pixel analysis.

This technique would be accomplished by two steps first of all detection of suspected regions or area for tumors or cysts in the CT scan image of brain on behalf the RGB range for tumor or cyst which is predicted or identified through comparative study done by collecting a CT scan samples showing tumor or cyst in their scan from different hospitals and clinics.

After identifying suspected RGB regions the edge or boundaries of these regions are marked with higher order of visual prominence in same image itself by applying edge detection method and color segmentation through algorithm developed by using MAT LAB tool.

After applying these steps the tumor and cyst regions are become more prominent and visible so that physician and healthcare professionals can easily recognize the minute regions of brain tumors and cysts in CT scan image.

The block diagram of the proposed work is given in figure 1 which depicts all the processing steps used in this work.

Step1: Database of images

Database will consist of number of images which would be CT scan of normal brain as well as tumor consisting brain both images should be captured on same intensity.

Step2: Development of pixel range with respect to intensity.

Now by using a database images develop a pixel range for normal brain and abnormal brain as well as the pixel differences between the affected region and normal region in abnormal brain image.

Step 3: Take test image to be verified for brain tumor or cyst

Now enter a test image into the process which should be taken on same intensity or pixel value/intensity relation could be developed and applied if intensity of images are not mach with data base images intensity.

Step 4: Segmentation:

In computer vision, segmentation refers to the process of partitioning a digital image into multiple segments (sets of pixels, also known as super pixels).

The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyze. Image segmentation is typically used to locate objects and boundaries (lines, curves, etc.) in images.

More precisely, image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain visual characteristics.

Step5: Edge detection on the basis of pixel to pixel variation

Edge detection is a fundamental tool in image processing and computer vision, particularly in the areas of feature detection and feature extraction, which aim at identifying points in a digital image at which the image brightness changes sharply or more formally has discontinuities.

Two basic properties of image intensity values are the basis for current segmentation algorithms; similarity and discontinuity. The principal approaches in the similarity category are based on dividing an image into regions that are similar to a set of predefined criteria. The approach for discontinuity algorithms is to partition an image based on abrupt changes in intensity.

Based on the following assumptions we can prove that the detected edges are good enough for further image processing applications.

1. Similarity of pixel values and
2. Pre-delineated intensity value

Let us assume that L represents a list of pixel values of the m x n (7x7 or 9x9) moving kernel window in the input image. Using the pre-delineated intensity value P, the list L is partitioned into two sub lists L1 & L2 delimited by the middle edge pixel 'x_m' where m = 1,2,….n. First we have to calculate the median. Here the x_m is the median value for the filtering window.

i. Take a moving kernel window of size mxn (7x7 or 9x9) around the pixel x.

Ii Calculate the median from the pixels of the kernel that to be placed as the middle element of the kernel.

iii Assign a value to the variable P for ex., 20, 25, which may or may not be less than the total number of similar pixels in the kernel.

To identify the edge pixels, checked the following condition
if $((x_i <= (x_m + P))$ &&
$(x_i >= (x_m – P)))$
c[i,j] = 1
else
c[i,j] = 0

iv Now we can get the edge pixels which have the value 1 and all other pixels have the value 0.Here we aregetting thick edges that means the edge pixel array can also consist of other pixels that satisfies the condition in the image. To avoid that we have to calculate the similarity measure by using the formula S= P/No. If the ratio of S <= 1 we get the thin edges or otherwise we get very thick edges.

V Finally we get the output image framed by using the detected edge pixels which forms the boundaries of the object.

Step 6 Verify the test image:
Now verify the input image and processed image abnormal region become prominent.

Algorithm

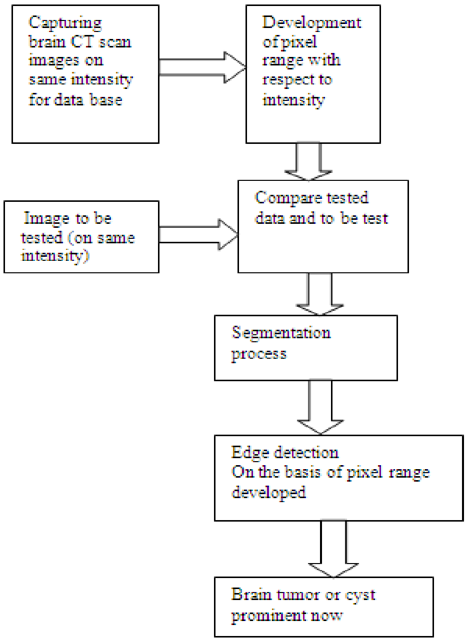

Figure 1: Block diagram (Algorithms) of the proposed work

IV. RESULT AND ANALYSIS

The above algorithm and method is applied to many of CT scan brain images that are suspected to brain tumour as well as the images of normal CT scan taken from CT scan centre **Safdarjung hospital New Delhi.** The result of segmentation and edge detection are shown below.

Table 1

S.no/Figure no.	Subject	Age/ Sex	Normal	Abnormal
2	Sample1	10/F		✓
3	Sample 2	42/F		✓
4	Sample 3	02/F		✓
5	Sample 4	10/F	✓	
6	Sample 5	40/M	✓	
7	Sample 6	32/M	✓	
8	Sample7	54/M	✓	


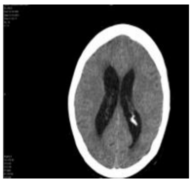

Figure 2 Sample1 (Brain tumor)**Figure 3**Sample 2 (Brain tumor)


Figure 4 Sample3(Brain tumor)**Figure 5**Sample 4 (Normal Brain)


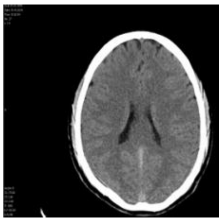

Figure 6: Sample 5**Figure 7:**Sample 6 (Normal Brain)

Figure 8: Sample 7 (Normal Brain)

Output 1:Where brain tumor has been detected after applying the above algorithms.

Figure 9: Sample 3 after applying the complete process tumor region is enclosed in white box which is clearly visible.

Figure 10: After edge detection on Sample 3

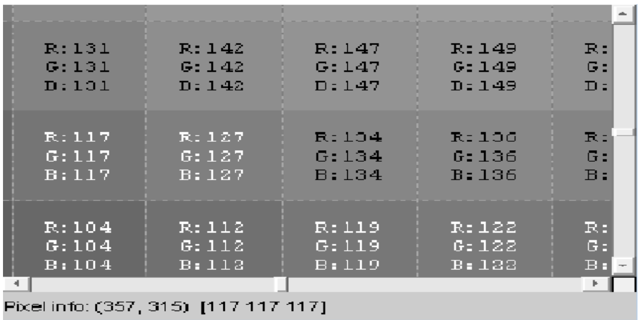

Figure 11: Pixel region of tumor edges which is detected shown in figure 9

Output2: Scan which has been found normal after applying the mentioned process.

Figure12: Sample 7 after applying the complete process no tumor has been detected.

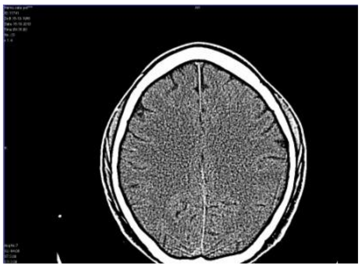

Figure 13: Sample 7 after applying the process (Edge detection and segmentation) no tumor region has been detected.

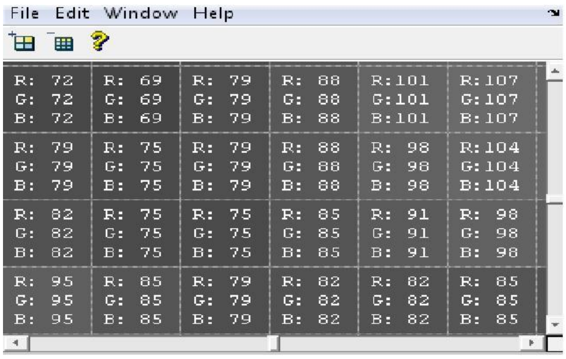

Figure 14: Pixel region of normal brain of figure12

V. CONCLUSION

The success of clinical validation and some future work will lead to a CT scan as revolutionary innovative and cost effective Medical imaging system with higher rate of reliability and preferences in Brain imaging field to assist radiologist as well as neurosurgeons with less complexities.

This leads to a different method with approximately similar results on brain tumor and cysts detection accuracy, although with some advantages on computational cost and understanding.

VI. FUTURE WORK

Development of this technique would be applied for the other CT scan images on different intensities for different parts of human body like Blood, tissues, Bone etc.

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