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Segmentation and Canny Edge Method in MRI Brain Cyst Detection

Vrushali D. Dharmale[1], P. A. Tijare[2]

Abstract

The detection of cyst in MRI brain image holds an important position in the area of image processing. In medical diagnosis, the detection of cyst in human brain requires much effort and hard to understand the task. With the help of image processing to make easier and simple. Medical diagnosis became fast due to such type of advanced techniques. The application is very useful for detection, recognition and classification. In this paper an approach has been attempted to detect the cyst in the MRI brain image, with the help of segmentation and edge detection method. The succeeding relevance result an efficient performance.

Keywords

Cyst detection, diagnosis, segmentation, edge detection.

1. Introduction

The aspire of our task is to find out a cyst from a particular MRI scan of a brain image using different image processing techniques. A cyst is a closed sac, having a distinct membrane and division compared to the nearby tissue. Cyst may contain fluid, minerals or tissues. A cyst can occur anywhere on the body. It may be formed on the skin surface or on fleshy tissue. The symptoms of a cyst depend on where the cyst is located. In some cases, the cysts can block the circulation of cerebrospinal fluid (CSF) and cause hydrocephalus, leading to headache, nausea and vomiting, double vision, or seizures. A cyst possibly will cause memory disturbances and behavioural trouble. There are hundreds of different types of cysts that can arise in the body. The most common types of cyst found in the brain are arachnoid, colloid, dermoid, epidermoid and pineal cyst. Cyst patients may be referred for a screening MRI and an early diagnosis would allow patients to choose pre-emptive treatment. This not only spares them from developing symptoms, but it lets them avoid the low but real risk of sudden death. Diagnosis is usually made based on neuro-imaging, and both CT and MRI can be used to this effect. These imaging modalities can often demonstrate the cystic structure that is blocking the flow of CSF as well as any associated hydrocephalus. Medical Imaging has had a great impact on the diagnosis of diseases and surgical planning. Magnetic Resonance Imaging (MRI) is an advanced medical imaging technique used to produce high resolution images of the parts contained in the human body. MRI provides good contrast between the different soft tissues of the body, which makes it especially useful in imaging the brain, muscles, the heart, and cancers compared with other medical imaging techniques such as computed tomography (CT) or X-rays.

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 (curves, lines 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. Edge detection is an important element in image processing, since edges contain a major function of image information. Edge is a basic feature of image. It provides image information that can be used for image interpretation.

2. Literature survey

Sometimes, it is difficult to distinguish the benign tumor from malignant ones. With the aid of image processing methods such as mathematical morphology which define the edge of the images, it becomes easier to identify the sizes, shapes and characteristics of pathologic cell images [1]. The edges of an image always include inherent information (such as direction, step character, shape, etc.), which are significant attributes for extracting features in image recognition. In most cases, pixels along an edge change gradually, whereas those perpendicular to the direction of the edge usually have much sharper changes.

Many authors used properties of wavelet transform coefficients and multi resolution theory only [2,3] for the segmentation of images but a composite feature vector comprising of wavelet and statistical parameters in contrast to other researchers who have developed feature vectors either using statistical parameter or using wavelet parameters. Generally speaking, arithmetic for edge extraction is to detect whether mathematical operators of the pixels are coincident with the features of the edge. In the past two decades

several algorithms were developed to extract the contour of homogeneous regions within digital image. In some images, edges are nothing but the object boundaries and they are useful for partition, registration and recognition of objects in a scene. S. Priyadarshini and G. Sahoo [4] have presented a new edge detection method that gives better edge detection accuracy. The paper proposed a new technique of edge detection that requires much lesser computation than Sobel's method and performs better than Sobel's method. The technique is based on additions and divisions. Nandita Pradhan & A.K. Sinha [5] have presented a Fuzzy Ann Based Detection And Analysis Of Pathological And Healthy Tissues In Flair Magnetic Resonance Images Of Brain by using a computational technique is proposed for the segmentation, detection and analysis of pathological tissues, healthy tissues and Cerebrospinal fluid (CSF) of brain with the help of FLAIR brain magnetic resonance images. Composite feature vectors are extracted from the blocks of size 4 × 4 pixels of intra-cranial brain image. L. Weizman and L. Ben Sira [6] have presented an automatic method for the segmentation, internal classification and follow-up of optic pathway gliomas (OPGs) from multi-sequence MRI datasets.

Shreetam Behera, Mihir Narayan Mohanty, Arabinda Mishra, [7] have presented a Cyst Detection an Image Processing Approach by using morphological analysis. The brain image has been considered to detect the cyst. A simple method of morphology in a new way has been applied for the purpose of detection. The morphological analysis is performed using different structuring elements of the medical image.

Ashika Raj [8] have presented a paper on Detection of Cysts in Ultrasonic Images of Ovary, Ultrasound imaging of the follicles gives important information about the size, number and mode of arrangement of follicles, position and response to hormonal stimulation. A thresholding function is applied for denoising the image in the wavelet domain. Before the segmentation process the ultrasonic image is preprocessed using contrast enhancement technique. Morphological approach is used for implementing contrast enhancement. This is performed in order to improve the clarity and quality of the image. Fuzzy c-means clustering algorithm is applied to the resultant image. Finally the cysts are detected with the help of clusters.

3. Proposed Method

There are various ways to perform edge detection. In this work canny edge detection method is used for good result. Medical image segmentation refers to the segmentation or partition of known anatomic structures from medical images. Structures of interest include organs or parts thereof, such as cardiac ventricles or kidneys, abnormalities such as tumors and cysts, as well as other structures such as bones, vessels, brain structures etc. It has been used for cyst or tumor recognition as well as for find out cyst or tumor boundaries. Image segmentation techniques [9] are mostly used in medical field for detecting diseases in human body structures such as nerves damage, blood vessels extraction and tumor detection. The overall objective of such methods is to assist doctors in evaluating medical imagery or in recognizing abnormal findings in a medical image.

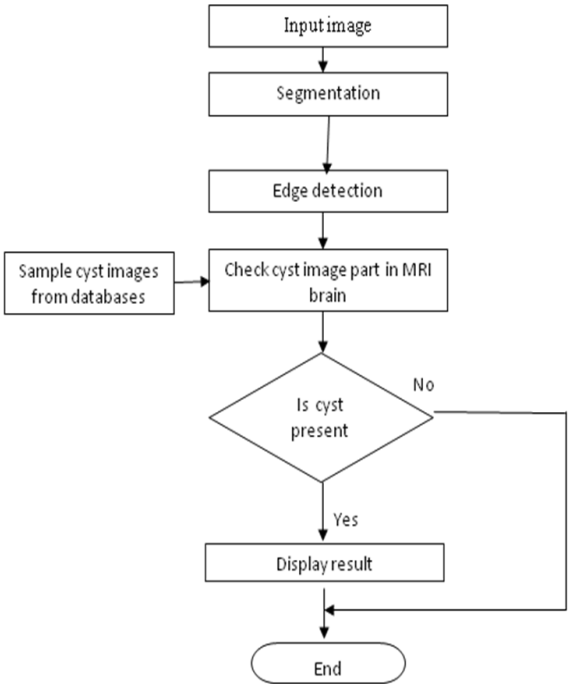

Figure 1: Data Flow diagram of proposed method

Initially, an input image is taken in which cyst is to be detected. Then, a segmentation algorithm is applied to segment the desired part of the image and detect the cyst. Image segmentation is an essential process for most image analysis techniques. Segmentation algorithms are based on one of the two properties of intensity values, namely discontinuity and similarity. First category is to partition an image based on abrupt changes in intensity, such as edges in an image. Second category is based on partitioning an image into regions that are similar according to predefined criteria. If cyst

is present in MRI brain image, then display the result. We have used these basic concepts to detect cyst in our work, the component of the image hold the cyst generally has extra concentration then the other segment and we can guess the area, shape and radius of cyst in the image. Image Enhancement is the improvement of digital image quality, without knowledge about the source of degradation. Image Enhancement is the technique to improve the interpretability or perception of information in images for human viewers [10]. It is to improve the image quality so that the resultant image is better than the original image for a specific application. Image enhancement is among the simplest and most appealing areas of digital image processing. Basically, the idea behind enhancement techniques is to bring out detail that is obscured [11]. Enhancement may be used to restore an image that has suffered some kind of deterioration due to the optics, electronics and/or environment or to enhance certain features of an image. Pre processing is a common name for operations with images at the lowest level of abstraction both input and outputs are intensity images. A pre-processing phase is needed in order to improve the image quality and make the segmentation results more accurate. The intention of these steps is fundamentally to recover the image and the image superiority to get more guarantee and ease in identify the cyst.

3.1 Algorithm for creating database of cyst samples

Step 1 : Read input MRI brain image.
Step 2 : Crop brain image (Remove Skull)
Step 3 : Enhance image
Step 4 : Compute Edge detection using Canny edge detection technique.
Step 5 : Pre-process image (Cyst detection)
Step 6: If cyst is present in MRI Brain Image then crop cyst portion otherwise go to step 8.
Step 7 : Segment database images.
Step 8 : End

3.2 Algorithm for cyst detection

Step 1 : Read input MRI brain image.
Step 2 : Crop brain image (Remove Skull)
Step 3 : Enhance image
Step 4 : Compute Edge detection using edge detection technique.
Step 5 : Pre-process image
Step 6 : If cyst present display the cyst portion else goto step 7.
Step 7 : End

3.3 Experimental Result

Results are shown below with image name A1.
Figure 2 is the MRI scan image; Figure 3 shows Enhanced Image; Figure 4 shows Edge Detect Image by using Canny edge detection method; Figure 5 shows pre-process image with location of cyst; Figure 6 shows the crop cyst sample.

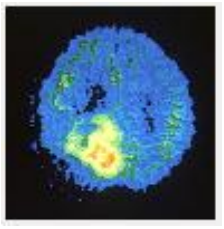

Figure 2 : Original Input Image

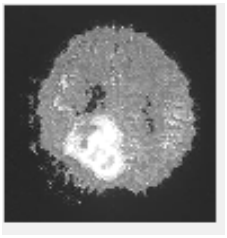

Figure 3: Enhanced Image

Figure 4: Edge Detect Image

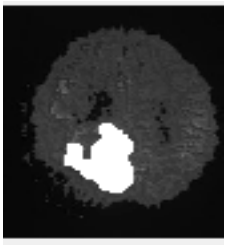

Figure 5: Preprocess Image

Figure 6: Crop cyst sample

3.4 Cyst Detection Result

This table1 and figure7 shows a cyst detection rate. In this table here we tested recognition rate on images i.e. .jpg, .png, .bmp, .tiff images which have no effect on rate. The recognition rate calculated by actual cyst presented in images with respect to cyst detected from them. At most it gives 100% recognition rate.

Table 1: Cyst Detection Result

Sr. No.	Input Image Name	Actual Cyst Present In Input Image	Cyst Detected	Recognition Rate	Cyst Recognized
1.	Image 1.jpg	01	01	100%	Yes
2.	Image 2.jpg	02	02	100%	Yes
3.	Image 3.g	01	01	100%	Yes
4.	Image 4.jpg	01	01	100%	Yes

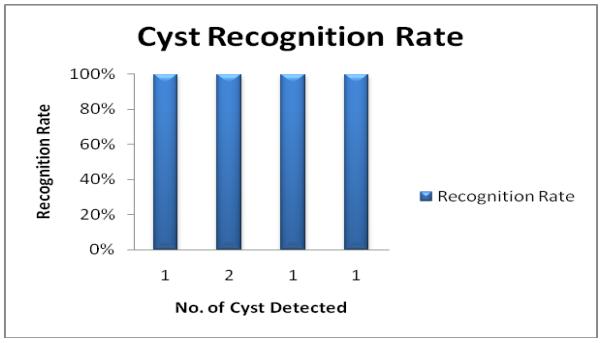

Figure 7: Recognition Rate of cyst detection

3.5 Some other Results are shown below

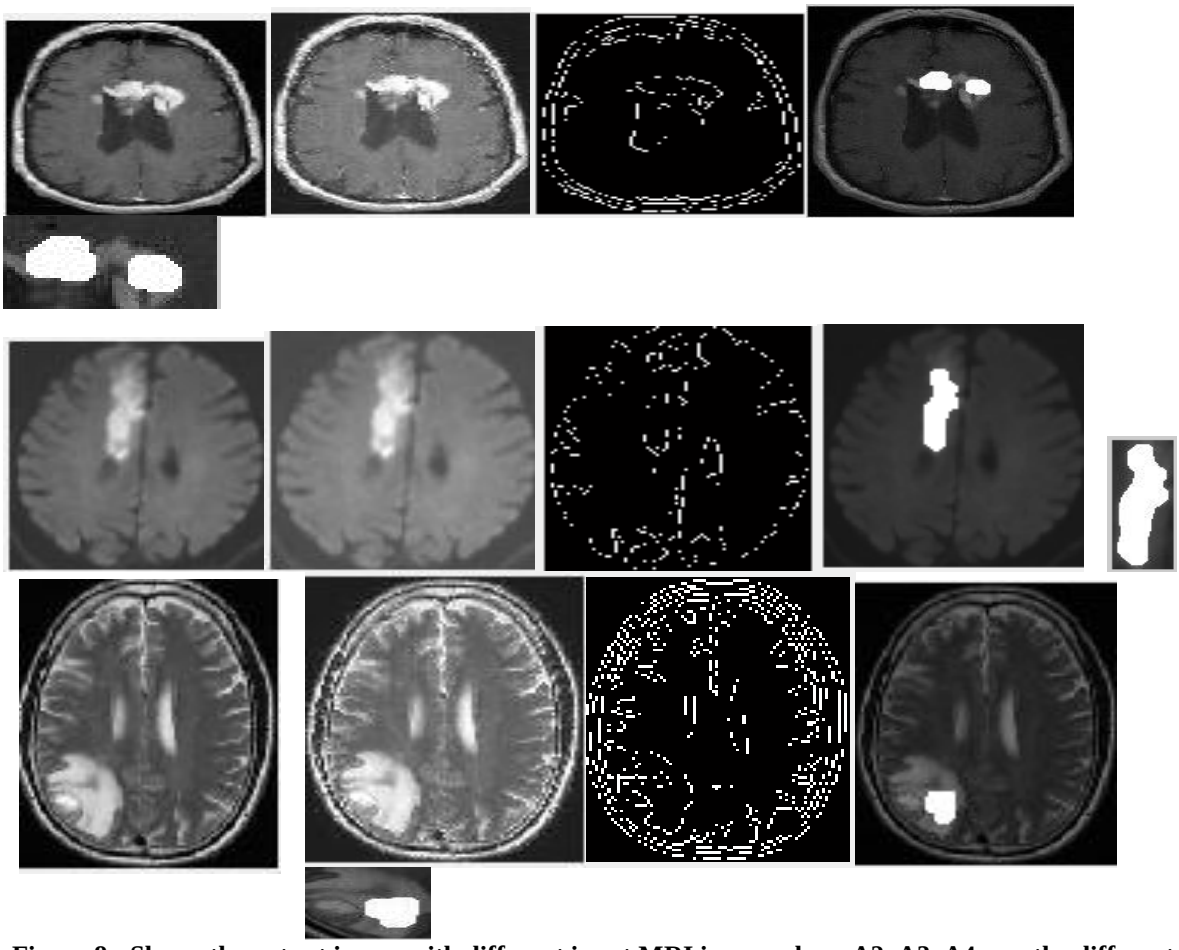

Figure 8 : Shows the output image with different input MRI image where A2, A3, A4, are the different input image name.

4. Conclusion

The propose approach gives very good results in detecting the cyst from a particular MRI scan of a brain image by using segmentation and canny edge detection method. The use of the system is to assist the physician to make the final decision. In medical diagnosis, the cyst detection in human brain is very difficult and complex task. So there is basic need of highly accurate and efficient cyst detection system. The task has been carried out by the help of image processing to make simple and easier.

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Vrushali Dharmale She is pursuing M.E. in the Dept. Of Information Technology, Sant Gadge Baba Amravati University, Amravati (Maharashtra), India. She received B.E. (Computer sci. & Engineering) from Sant Gadge Baba Amravati University, Amravati.

Pritish A.Tijare He is Associate Professor of Dept. Of Computer Science & Engineering, in Sipna College of Engineering and Technology, Amravati (Maharashtra), India. He has published many papers in the Conferences/ journals. He is life member of IETE, India.