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RESEARCH ARTICLE

Differences Between Edge Detection And Boundary Detection.

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Abstract

This paper presents a novel method of detecting results of images through edge detection process and also comparing Edge detection process with boundary detection process, which makes boundary detection process more reliable towards the detection of 3-D, tumour brain and noisy images. This work is aimed for the development of a MATLAB based interactive platform for Traditional-Median edge detection algorithms in coloured images. MATLAB provides a comparative analysis between the existing Traditional edge detection algorithm and boundary detection algorithm and presents the output results in figures. In this paper we have presented the results based on the above three parameters.

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Introduction:-

Edge detection is considered an important process in image processing and computer vision with a large number of studies published earlier. The term 'edge' stands for a local luminance change for which a gradient can be defined and which is of sufficient power and strength to be considered important for a given task. It is defined as a set of connected pixels that form a boundary between two disjoint regions. It can also be defined as the process of locating and identifying sharp discontinuities in images. These discontinuities are caused by various factors like reflection of light, shadows or illuminations formally. Edge detection is a process that consists of detecting the boundaries of that region where there is change in a single pixel also. The points at which image brightness changes sharply are typically organized into a set of curved line segments called as edges. Edge information is often used to determine the boundaries of an object. On the other hand, boundary detection is a technique of detecting boundaries where the group of pixels of same parameters combine to form a region. Both the approaches are used to observe the boundaries in the images.

Methodology:-

We have used Matlab software for detecting the result of the edge detection and boundary detection technique. Matlab is a platform where a user can obtain result through the various codes writing in the command window. The Matlab version used is Matlab R2013a. through the programming values of the boundaries are detected on the basis of degree of roundness. Below is the flowchart showing the steps involved in the process of Edge Detection, through these steps we obtain the results in the form of detected boundaries. We have given three images (3D, medical and noisy) as input to the Matlab and the corresponding results have been studied.

The process begins with providing input, then filtering the image by removing the noise and filling the holes. After that the output image is labelled to RGB and boundary is detected.

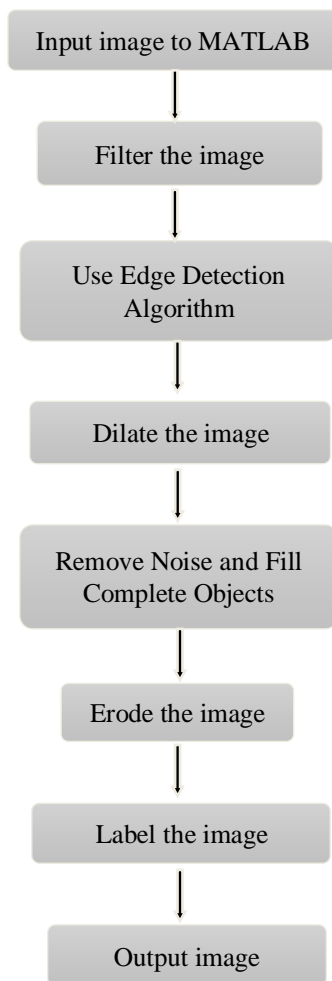


Fig1:- Flow Chart of Edge Detection Process

Comparison between boundary detection process and edge detection process

Boundary detection is a higher level technique used for determining the outer boundaries of the object that is to outline the shape of the image. Whereas, Edge detection is a low level technique which helps in determining the inner edges as well as outer edge. E.D. is mainly used for analysis to derive similarity criterion for a predetermined object. There are basically three parameters of comparison between E.D. and B.D. on which we have focussed our research work and these parameters are:

1. Taking 3D Image- The first comparison is made on the basis of providing 3D image as an input to the MATLAB. we have taken a normal brain 3D image on which we will employ the both techniques and will compare the output images.

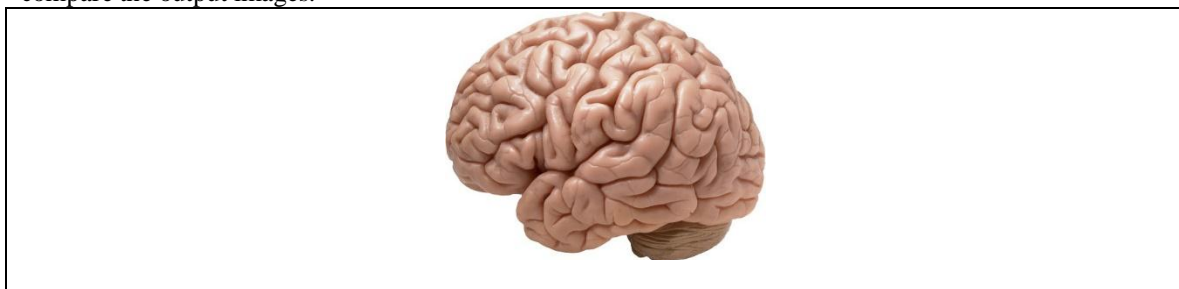


Fig2:- 3D Image of Brain

2. Taking Brain Tumour Image- This is the second comparison made by taking the brain tumour image as an input. the brain tumour image means the scanned image of the brain and we have shown the result by comparing the values on the basis of degree of roundness.



Fig3:- Brain Tumour Image

3. Taking Noisy Image- The last comparison has been made by taking the noisy image as an input to the Matlab, noisy image is aRGB medical image of the various internal organs.

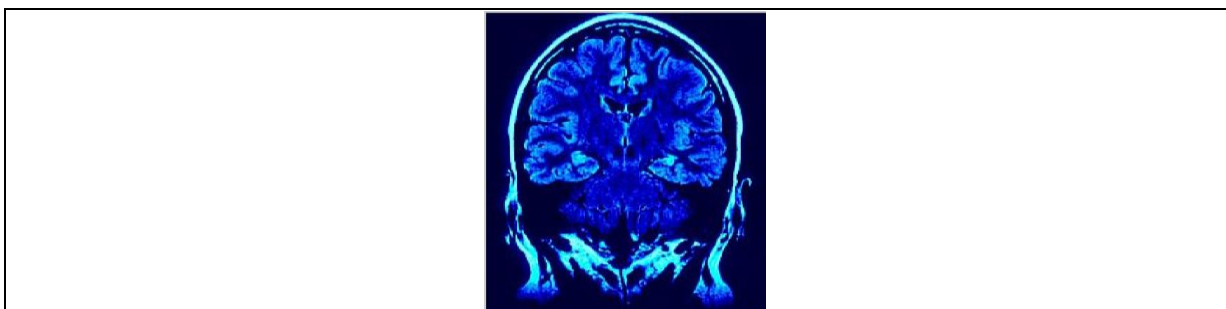


Fig4:- Noisy Image

Results:-

Now, we are showing the results of the above parameters when operated with the edge detection and boundary detection techniques. Following are the results obtained in the form of output images.

1. 3D Image Results- When the normal brain image is employed with the boundary detection process we get the detected boundaries inner as well as outer boundaries and most of the regions are labelled to RGB with different colours but when the same input is employed with the edge detection process we get only one detected boundary of a region.

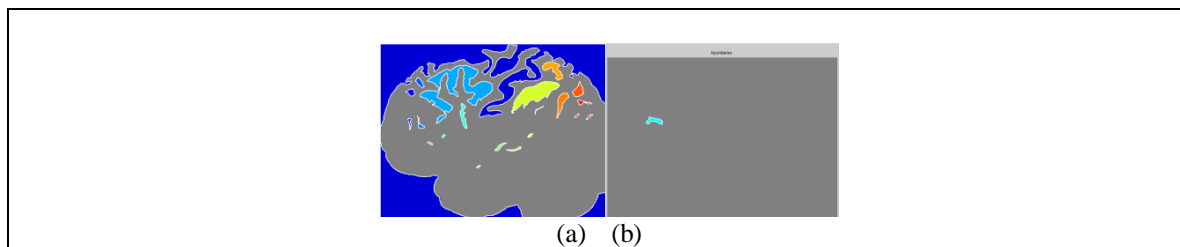


Fig5: 5(a):-Boundary Detected Output,5(b) Edge Detected Output

2. Tumour Brain Results- Fig5 shows the output images when tumour brain image is given as input. The result shows the variation in the number of the boundaries and the values of the corresponding boundaries.

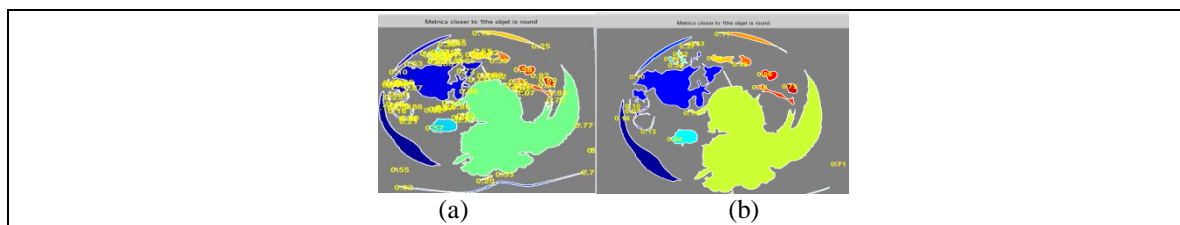


Fig6: 6(a):-Boundary Values For Boundary Detection, 6(b) Boundary Values For Edge Detection

3. Noisy Image Results– When the input noisy image is employed with the Boundary Detection it provided the result with the white outlined boundaries of the various regions whereas when the same is employed with the Edge Detection the result is not obtained instead we get the blank output with no detected image.

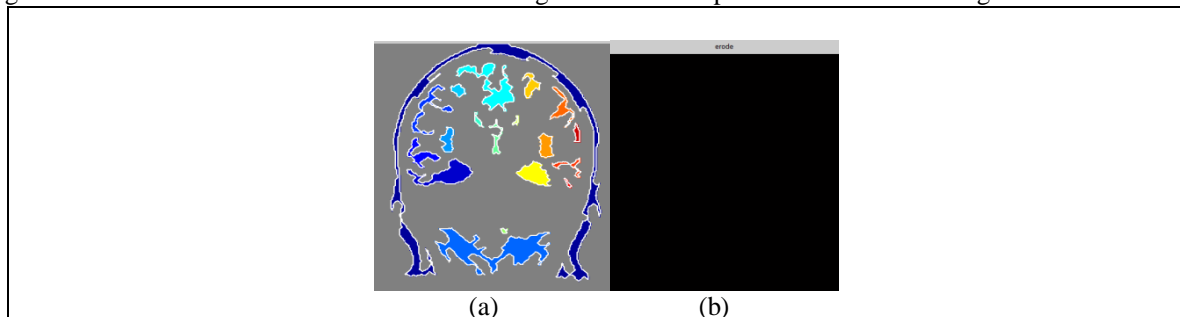


Fig7: 7(a):- Output of Boundary Detection Technique, 7(b) Output of Edge Detection Technique

Now, we are showing the values of the boundaries when the Tumour Brain is fed as an input to Boundary Detection Technique and Edge Detection Technique respectively. In the table the bolded values show the maximum value obtained for the corresponding Detection Techniques.

Table1:- Different Values of Brain Tumour Image with Both Techniques

FOR BOUNDARY DETECTION		FOR EDGE DETECTION	
OBJECTS	VALUES	OBJECTS	VALUES
O1	0.04	O1	0.11
O2	0.30	O2	0.13
O3	0.82	O3	0.16
O4	0.57	O4	0.1
O5	0.59	O5	0.64
O6	0.28	O6	0.63
O7	0.96	O7	0.33
O8	0.37	O8	0.37
O9	0.28	O9	0.12
O10	0.24	O10	0.18
O11	0.88	O11	0.75
O12	0.97	O12	0.36
O13	0.54	O13	0.44
O14	0.38	O14	0.07
O15	0.36	O15	0.36
O16	0.11	O16	0.39
O17	0.68	O17	0.02
O18	0.15	O18	0.71

Conclusion:-

The conclusion has been made on the basis of obtained results, on observing the output of the mentioned parameters in the paper it is clear that Boundary Detection technique serves best for detecting the boundaries in any kind of images whether 3D or medical or noisy image whereas Edge Detection is a low level technique employed for

limited images. Edge Detection does not work on noisy image since both edge and noise hold high-frequency content which results in very less localization of the detected edges and hence no result is obtained, whereas Boundary Detection provides result. The concept of 'noholes' used in Boundary Tracing Technique will accelerate the process by preventing it from detecting the inner contours. On the other hand, concept of 'fill holes' in Edge Detection process will fill the closed loops completely and will vanish the holes completely. It is also observed that Tumour Brain image when processed with Edge technique shows very less detected boundaries and of low values. The maximum values obtained through Edge Detection process are 0.75 and 0.71, whereas much more values are obtained in Boundary Technique and also with the maximum values of 0.96 and 0.97 which determines the degree of roundness of an object and which makes the clear detection of tumour present in the brain. But Edge detection has an advantage of detecting much precise boundaries of the object as it depends upon change in pixel intensity whereas Boundary detection only outlines the shape of an object and does not show every boundary in the object. Thus, this paper deals with a comparison between Edge Detection and Boundary Detection that has been shown with the help of images.

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