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Segmentation Brain Tumor and Diagnosing Using Watershed Algorithm

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ABSTRACT: *Brain cancer is the most life impacting and most critical type of malignancy considering the sensitivity of the location in which it affects, the brain being the most important part of the body yet its cells lack the ability to divide and heal the damaged tissue. Most brain tumors causes are unknown; they're the second leading cause of cancer-related deaths in children and young adults under 20, with generally low average survival rates. There are over 120 types of brain tumors, most are cancerous. Sadly, there are no effective ways to prevent brain tumors however for many tumors, surgery and radiotherapy remain the standard of care for early stages. The early discovery of a brain tumor can play an important role in reducing the mortality rates and associated lethal effects as well as to diagnose and manage the case, resulting in a higher recovery rate for the patients. This paper deals with tumors that start within the brain, using morphological watershed algorithm on Magnetic Reasoning Images (MRI) to identify, locate and segment the tumor. The basic idea in this paper is to design software and use the proposed system to help the physician reading and classifying the type of tumors into benign or malignant. The experimental result shows that the cases been diagnosed using our system verses the radiologist diagnosis are correct with percentage over 100% for the most of the cases.*
Keywords: *Segmentation, Watershed, MRI, Feature.*

I. INTRODUCTION

Image segmentation is the core of image processing; any image analysis must go throw image segmentation first to extract the useful information from the image. Several steps is being done before segmentation like preparing the image to be segmented for example eliminate the noise enhance the image sometimes eliminate the small details that are unwanted in image segmentation process then after cutting the part that wanted from the image now the extracting phase is ready in this phase. Each study is different from each other when sometimes we need to find the darkest spot, edges, boundaries,lighter spots,lines or curves etc [1].

There are so many studies on cancer in general and on brain cancer in particular the aim of these studies most of the time is to find cure or to know the reason of this fatal disease till these days the progress is very weak therefore this studies should keep going. This paper is to implement a system that helps the doctors and physicians to gives very precise decision and to help with the critical cases since its very sensitive topic.Brain tumors is on the top of the worst type of cancer list regarding to the critical location, this type of cancer came as tumor take place in the brain tissue or the surrounding area [2][3].

This paper introduce several mask to obtain the optimal segment since it is a critical topic involving human health and after the process of segmentation methods and the method that being used.In this paper a classification method will be proposed to classify the tumor wither its benign or malignant to obtain the best result so the patient will have some kind of therapy or surgical interference [2].

1. Image segmentation [1]

Image segmentation is defined as partitioning digital images into several regions (sets of pixels), the aim of segmentation is to simplify the representation of an image to something more meaningful and easy to work with and analyze. Image segmentation is mostly used to locate object and its boundaries, in another way it can be defined as abstracting an object from the original image by marker the foreground in high level grade and marker the segments low level grade. Segmenting a digital image should have two points of a view, the first one, which is called preprocessing, includes evaluating the (input image) regarding size, quality, color density, type, noise…etc. The other point of view, evaluating the (out coming) segment value-wise the wanted part to be extract from that image related to the original work.

A large number of segmentation methods proposed over the last decades, such as canny, sobel, prewitt, Robert's Cross and many other techniques. Another method watershed will be discussed in the following sub section [1].

II. SEGMENTATIONUSINGWATERSHED

Watershed is one of the well-known methods in segmenting image processing; the concept was born in 1979 and has developed over time. It's presenting as an algorithm or as hardware device that watershed technology embedded. In this paper a watershed will be presented in practice first with markers, then the improved watershed, in order to provide very accurate segment [4].

The basic Idea of watershed was placing source of water in each minimum in the relief, to flood the whole area with water ,then where different water sources are meet together that where barriers will form.Morphological watershed presents a complimentary approach to segment objects. It is especially designed for segmenting objects that is near to another. One of the most common watershed was the one that presented by F. meyer 1990[5].

That algorithm designed to work the best with gray scale images during flooding the gray relief by water sources, the catchment basins start to form and construct the watershed boundaries, this process is applied to gray scale image basins then emerge with the edges. At the normal cases this will lead to over segmentation, especially for image with some data of noise, Medical CT dara and MRI images either the image must re-processed or some of the regions must combined with basis of similar criterion [4] .

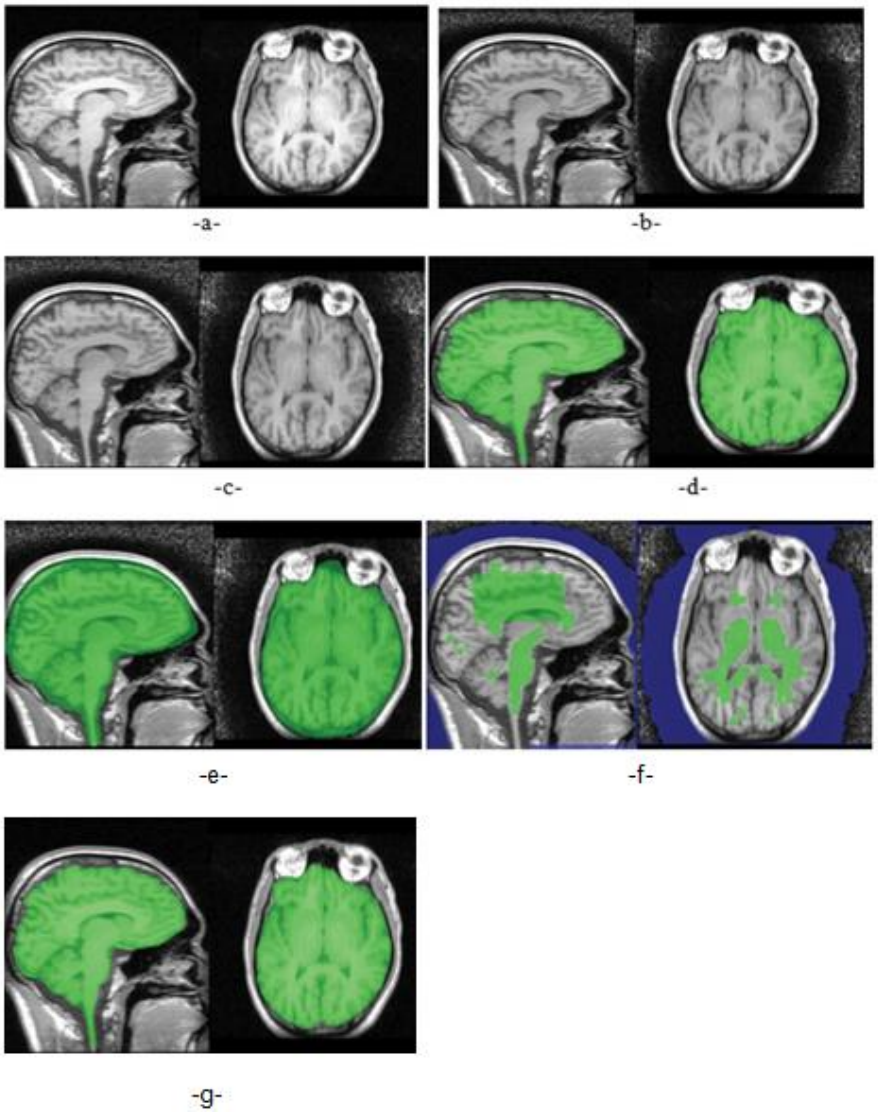


Figure (1) MRI brain image show using several marker controllers to extract region of interestWhere in image (a) Original image (MRI), (b) image after homogeneity correction,(c) neck is being crop, (d) stage 1 markers(MN1), (e) Extracting brain (B1), (f) stage 2 marker controller(MN2) and gradient base image, (g) Brain segmentation

III. CHARACTERISTICS OF MRI IMAGES

The term Magnetic Reasoning Image (MRI) refers to the type of how the image taken or being formed in this type of medical images uses magnetic field and radio frequency to provide inside look to the human body as a visual anatomy that shows the organs, boy tissues, vesicles and tumors [6].

MRI gives digital images that is much different of any other in the density of the image that can show many different tissue type in one image and in so many levels major advantage of that quality, some pathologist can see more than one characteristic of the organ at one time that what makes MRI one of the complex images than most of digital imaging. In order to use that kind of imaging in researches, researcher must have a very close look on its characteristic that can be controlled [6].

IV. IMAGE CLASSIFICATION

Digital images obtained a very high place in all sciences, classifying images regarding to what type of data they carry very important that will make retrieving image a lot easy along with storing and study them. Classifying image is also useful to help the researchers to develop their work and extract useful information from the images. Classifying image mostly about study pixels and categorize them in digital images, that means categorize data according to the spectral of the land cover in an image. Most of the time multispectral data are being used to perform the classification, then the spectral pattern is presented in each data pixel that used as a numerical basis for categorizing the advantage of classifying digital images that is used identify and describe as a very identical gray level or colored feature in the digital image [7].

The most important thing about digital image analysis is that classification in common perspective people love to store a beautiful image without knowing anything about it but that means nothing without knowing that each image showing a magnitude of many colors that form the image and there useless[7].

V. FUZZY LOGIC

Fuzzy logic and fuzzy set of theory gives multi solutions to the mathematical morphology algorithm regarding processing the gray scale images. It's the group of all methods that understand, process and represent digital images. For their segments and also their features as fuzzy sets that represen depends on the technique of fuzzy logic that been selected and also depend on the problem to be solved, fuzzyfication of an image data (coding) and defuzzification (decoding) [8].

These two steps make it possible to process an image with fuzzy logic technique, the fuzzy image processing strength point is the modification of the member ship values, when digital image data is changed from gray scale plane into membership plane (fuzzification)[8].

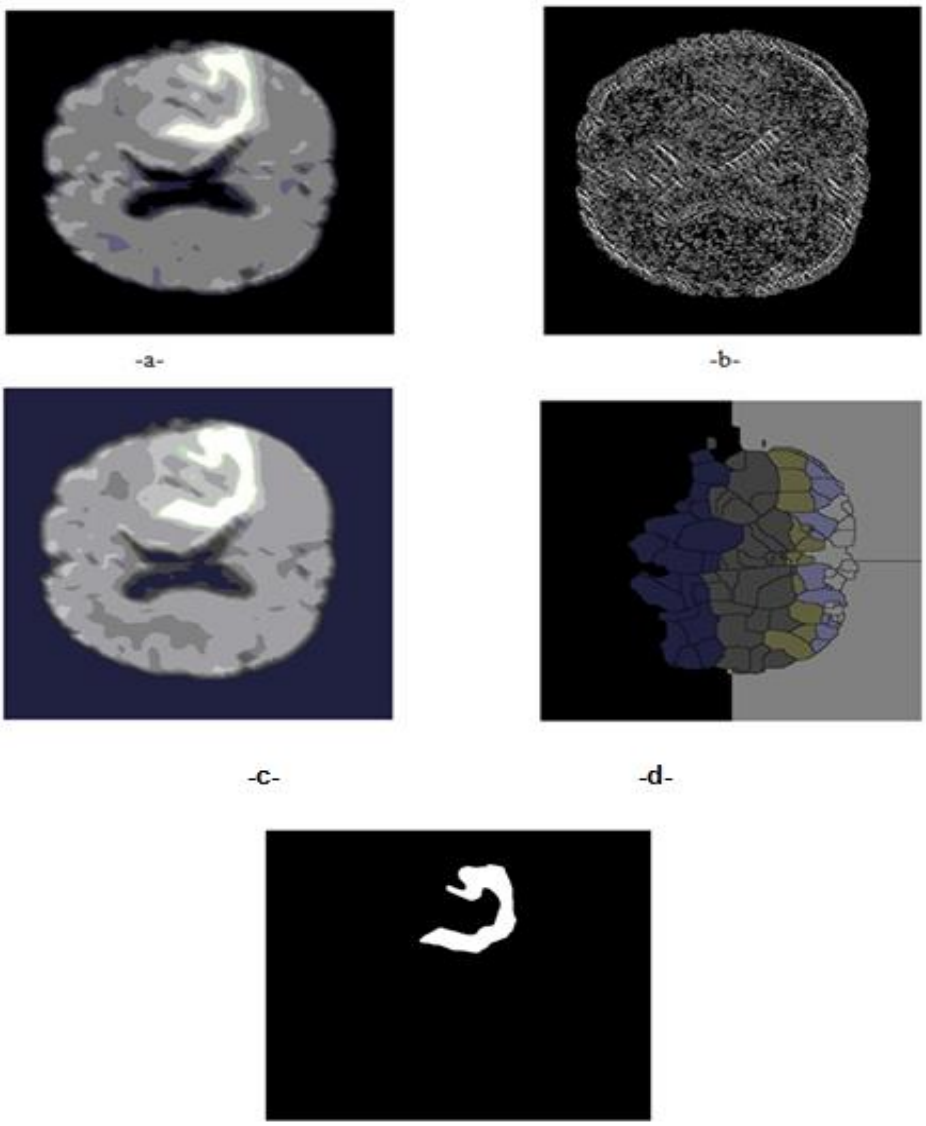
VI. THE PROPOSED METHOD BY APPLYING THRESHOLD AND WATERSHED

When applying threshold on input image that pre-processed before the thresholding will be more accurate to extract the segment from the image depending on the contrast, first the image will be resized then a certain threshold filter to the median image followed by calculate the 2-dimentional watershed segmentation using the 4-neighborhood connectivity that works on the vertical and horizontal directions of the images for the optimal threshold that have been denoted previously be the stop sign for the region growing seed of the segment, algorithm(1) shows the proposed method of thresholdinng watershed and shows the steps.

Algorithm (1) Apply Thresholding and watershed
Input: filtered image
Output: segmented image

BEGIN
 	
Step1: Resize Trilateral filtered image to 512 x 512 pixels.
 	
Step2: Apply median filter on the summed Image
 	
Step3: Compute gray thresholding of the median filtered image
 	
Step4:
 	
If TH>5 **then**
 	
TH= TH+5;
 	
end if

Step5: Extract No. of connected neighborhood.
Step6: Compute 2-dimensional watershed of the median
filtered image using NHood Connectivity.
Step7: Compute 2-dimensional binary Image from the
watershed image using the obtained threshold TH.
Step8:obtain the 3 x 3 binary Mask of 1 neighborhood connectivity
Step9:obtain the 11 x 11 binary mask of 6 neighborhood connectivity
Step10: Apply image erosion on the watershed image BNN using the mask MSK1.
Step11: Apply image dilation on the BW1 image using the mask MSK1.
Step12: Apply image erosion on the image BW2 using the mask MSK6.
Step12: Apply Image Dilation on the BW3 image using the Mask MSK6
END



Figure(2) shows image result in proposed approach where -a- image using the Treliateral filter, -b- using Median filter, -c- using Thresholding, -d- using watershed and f using the binary filter

VII. FUZZY ROLE

In this paper fuzzy function will be used over the parameter that been extracted from the MRI imaging to determine the tumor type if it was malignant or benign depending on two parameters which they are the area of the tumor and the color variant contrast that been collected from the segment itself these two parameter entered the fuzzification and gives one dissension after the if role statement and the result is either malignant or benign as shown in figure (3).

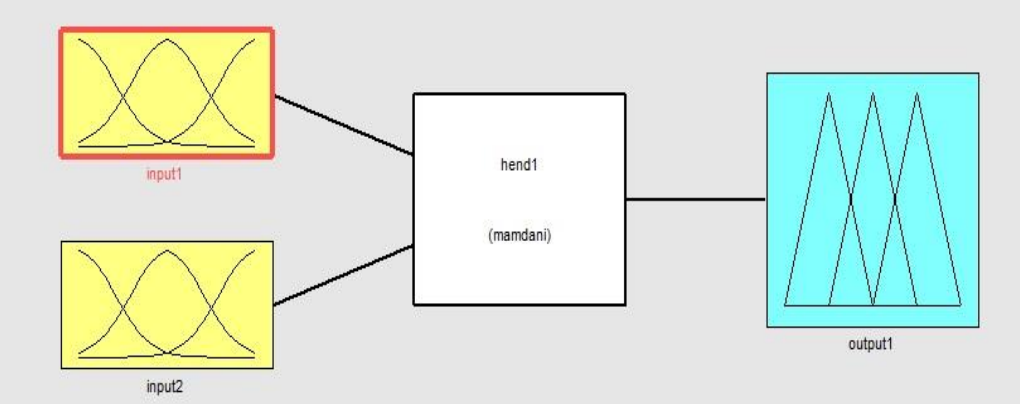


Figure (3)

VIII. CONCLUSION

This paper describe the segmentation using watershed segmentation and edge detection, classification tumors using the fuzzy role result shows the classification depend on the segment area and the color variation the segmentation and classification is performed using MATLAB software.

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