# Brain Tumor Detection With Histogram Equalization And Morphological Image Processing Techniques

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**Abstract**

Accurate segmentation of brain tumors in MR images is challenging due to overlapping tissue intensity distributions and amorphous tumor shape. This study aims to realize mass detection process on brain MRI (Magnetic Resonance Imaging) images. This paper describes the system that is based on histogram equalization and morphological image processing techniques. We tested the results to calculate the effectiveness of the techniques used for segmenting the tumor region in brain images and digit.
**Keywords: Brain Tumor, Detection, Histogram Equalization, Morphology, and Segmentation.**

## I. INTRODUCTION

Image segmentation is the partition of an image into a set of non-overlapping regions whose union is the entire image. In the simplest case, one would only have an object region and a background region. Magnetic resonance imaging (MRI) is often the medical imaging method of choice when soft tissue delineation is necessary. This is especially true for any attempt to segment brain tissues, normal or abnormal. Image segmentation is a tool that has been applied to medical imaging modalities to differentiate tissue types for purposes of volume measurement and visualization. Practical Applications of Image segmentation in medical field are Locate tumors and other pathologies, Measure tissue volumes, Computer guided surgery, Diagnosis, Treatment planning, Study of anatomical structure. Other areas of applications of Image Segmentation are Locate objects in satellite images (roads, forests, etc.), Face Recognition, Finger print Recognition, etc.

A tumor or tumor is the name for a neoplasm or a solid lesion formed by an abnormal growth of cells (termed neoplastic) which looks like a swelling. Tumor is not synonymous with cancer. A tumor can be benign, pre-malignant or malignant, whereas cancer is by definition malignant. There are three types of tumor namely Benign tumor, Malignant, and premalignant.

## II. PREVIOUS WORK

D. Mumford Shah and J. Shah proposed the image segmentation method [1]. This segmentation method finds a contour, which segments the image into non-overlapping images. This segmentation method applies on homogenous intensity images. The advantage of this method is that it automatically proceeds in the correct direction without any additional term. This algorithm is working on multiple disjoint regions. The computational cost of solving the estimating PDEs is very high and it is difficult to minimize the function if the contour C is not known. D. Selvaraj and R. Dhanasekaran proposed a Novel approach for segmentation of brain MRI. This approach is based on intensity-based thresholding to get the boundaries of the normal brain tissues such as CSF, GM and WM. This approach is consisting of two stages one is pre-processing and the other is segmentation. Skull stripping is the first pre-processing step in the segmentation of brain tissue. In the second step, we apply the orthogonal polynomial transform to the skull stripped image and segment the CSF from the brain MRI image. For the segmentation of the GM and WM firstly the skull stripped image is smoothened by applying Gaussian convolution filter and then calculate the x, y gradients of the smoothened image. With the help of these gradient values marked the edges present in the image and then perform binarization and morphological operators for removing the noise from the image. This method is easiest and fastest but the problem is pre-processing of and preregistration of medical images[2].

Andy Tsai and Anthony Yezzi et al. proposed the extension of the Mumford Shah function. This method handles the problem of the missing data that is due to intensity saturated and defective pixels of the infrared sensor[3]. With the help of the prior smoothness constraint this algorithm fills the gaps. This method performs segmentation, denoising and interpolation of images with missing data. In this paper several approaches made our algorithm fast, efficient and handling important image features such as triple point and multiple junctions [4].

Virginia L. Ballarin et al. proposed a k-means algorithm, which is an automatic segmentation of the brain tissue. The weighted k-means algorithm weighs the number of pixels corresponding to each set of grey levels in the feature vector. The feature vector X=(x1, x2, x3) Where x1, x2, x3 are the grey levels of the three images and these images are of the same size, represents a pattern in R3 space. To compute the centroids, we can use weighted k-means algorithm. It calculates the number of times a specific pattern X appears in the images by using weighted means. P1 (1), P2 (1) …….., Pk . At the qth iterative step, we can distribute the X samples into the K clusters and assign each sample to the cluster whose centroid is nearest depend upon the Euclidean distance using the following relation. The problem in weighted k-means is that the method is purely based upon the intensity so the chances of misclassification of brain tissues are more [5].

Lee et al. proposed a method of segmentation of the computer tomography (CT) brain images. This method is classified into two parts pre-processing and segmentation. Pre-processing: In pre-processing firstly, we increase the contrast of the original image. The next step is to remove the background and skull from the image and extract the intracranial area. Reduce the partial volume effect on the boundary of the intracranial area by using the canny algorithm and normal region is disconnected from the abnormal region after removing the edge. After the reduction enhance the contrast of the abnormal region. Where is the upper limit, is the lower limit. In this we can use the median filter to remove the salt and pepper noise. Segmentation: This section presents the segmentation techniques applied to the abnormal enhanced image. There are many segmentation techniques such as Otsu threshold, K-means, Expectation Maximization (EM) method and Fuzzy c-means (FCM) with population-diameter independent (PDI). The FCM with PDI method is the best to segment CT head images. The result after the EM segmentation is very noisy as compared to the FCM with PDI. The contribution of small and large clusters is accurately balanced by the FCM with PDI [6].

Chunming Li et.al proposed a Variation level set formulation method that is a region-based method. This algorithm segments the whole image. It overcomes the problem that occurred due to intensity inhomogeneity. In this method we first define Region Scalable fitting (RSF) energy function and then localization is performed by two fitting function f1 and f2. This algorithm is able to segment inhomogeneous objects. The standard gradient descent method is use to minimize the energy functional[7].

## III. METHODOLOGY

For the image Segmentation of Brain tumor to be done, we apply filters on enhanced Image, The technique manipulates the image histogram in such a way that no remapping of the histogram peaks takes place, while only redistribution of the gray-level values in the valley portions between two consecutive peaks takes place. Then Edge detection is done using Prewitt operator. After that segmentation of image is done to locate tumor. The technique consists of following operational stages: Image Enhancement**,** Edge detection, Morphological Erosion and Dilation**,** Segmentation

### *A. IMAGE ENHANCEMENT*

Image enhancement is done using BPDFHE technique [8]. The technique manipulates the image histogram in such a way that no remapping of the histogram peaks takes place, while only redistribution of the gray-level values in the valley portions between two consecutive peaks takes place.

*(1)Fuzzy Histogram Computation.*
*(2)Partitioning of the Histogram.*
*(3)Dynamic Histogram Equalization of the Partitions.*
*(4)Normalization of the image brightness*

### *B. EDGE DETECTION*

The prewitt edge detector is an appropriate way to estimate the magnitude and orientation of an edge. This gradient-based edge detector is estimated in the 3x3 neighborhood for eight directions. All the eight convolution masks are calculated. One convolution mask is then selected, namely that with the largest module. An Edge in an image is a significant local change in the image intensity, usually associated with a discontinuity in either the image intensity or the first derivative of the image intensity. Discontinuities in the image intensity can be either Step edge, where the image intensity abruptly changes from one value on one side of the discontinuity to a different value on the opposite side, or Line Edges, where the image intensity abruptly changes value but then returns to the starting value within some short distance. However, Step and Line edges are rare in real images. Because of low frequency components or the smoothing introduced by most sensing devices, sharp discontinuities rarely exist in real signals. Step edges become Ramp Edges and Line Edges become Roof edges, where intensity changes are not instantaneous but occur over a finite distance. Edge detection contains three steps namely filtering, enhancement and detection [9].

### *C. MORPHOLOGY*

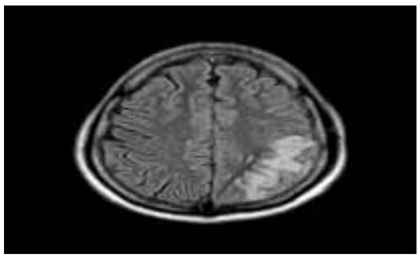
(1) Dilation
(2) Erosion
(3) Opening
(4) Closing

Above all are the basic mathematical morphological operators. Dilation is defined as the maximum value in the window. Hence the image after dilation will be brighter or increased in intensity. Dilation is the operation that combines two sets using vector addition of set elements. It also expands the image and mainly used to fill the spaces. Erosion is just opposite to dilation. It is defined as the minimum value in the window .The image after dilation will be darker than the original image .It shrinks or thins the image. Opening and closing both parameters are formed by using dilation and erosion. In opening, firstly image will be eroded and then it will be followed by dilation. In closing, first step will be dilation and then result of this is followed by erosion. All operators perform their tasks by using structuring elements, which is a matrix of 0's and 1's.structuring elements have various sizes and shapes.

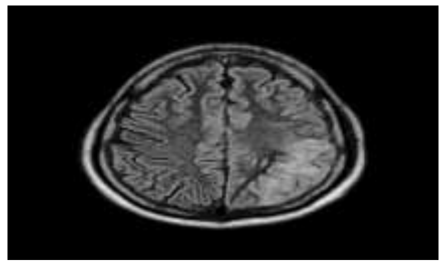
### *D. SEGMENTATION*

Segmentation is the process that divides the images in significant regions. The purpose of segmentation process is to separate ROIs or objects from the background significantly. In the gray-level images, gray level and luster are basic features used to separate the images to the ROIs. In addition, color and texture features are also used. In this stage, from the morphological image processing techniques; dilation and erosion techniques are applied to determine the ROIs on the image.

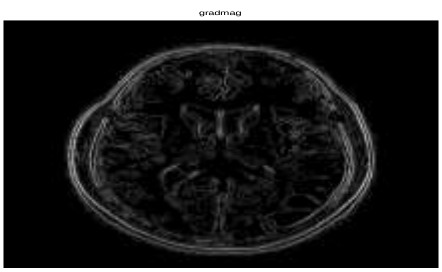
## IV. EXPERIMENTAL RESULTS



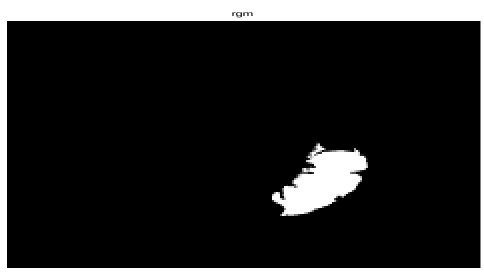
ORIGIONAL IMAGE



ENHANCED IMAGE




EDGE DETECTED IMAGE




ROI


## V. CONLUSION

From the experimental results it has been concluded that this method segments the tumor from the background of the brain MRI. This work is really efficient platform for researchers and scientist. The proposed model is able to segment images with intensity inhomogeneity, and has desirable performance for images with weak object boundaries. Possible extension of the presented work is to segment the multiple junctions. This way the result may be more accurate.

## REFERENCES


[1] D. Mumford and J. Shah, "Optimal approximations by piecewise smooth functions and associated variational problems," Commun Pure Appl. Math., vol. 42, pp. 577-685, 1989.

[2] D. Selvaraj, R. DhanasKaran, "Novel approach for Segmentation of brain magnetic resonance imaging using intensity based thresholding ", ICCCCT 10, 2010.

[3] A. Tsai, A. Yezzi and A. S. willsky, "Curve evolution implementation of the Mumford-Shah functional for image segmentation, denoising, interpolation and magnification," IEEE Transaction Image Processing, vol. 10 No. 8, pp. 1169-1186, August 2001.

[4] B. Merriman, J. Bance and S. Osher, "Motion of multiple junctions: A level set approach," J. Comput. Phys. Vol. 112, No. 2 pp. 334-363, 1994.

[5] Guillermo N. Abras and Virginia L. Ballarin, "A Weighted K-means Algorithm applied to brain tissue classification", JCST Vol.5 N0.3, October 2005.

[6] Tong Hau Lee, Mohammad Faizal, Ahmad Fauzi, Ryoichi Komiya, Su-Cheng Haw. "Unsupervised abnormalities extraction and brain segmentation", IEEE 3rd International conference on Intelligent System and Knowledge Engineering, 2008.

[7] J. A.Yezzi , A. Tsai, and A. Willsky, "A fully global approach to image segmentation via coupled curve evolution equations", J. Vis. Comm. Image Rep., Vol. 13, No.1, pp. 195-216, March 2002.

[8] Debdoot Sheet, Amit Suveer, "Brightness Preserving Dynamic Fuzzy Histogram Equalization", IEEE Transactions on Consumer Electronics, Vol. 56, No. 4, pp. 2475-2480, November 2010.
[9] Jamil A. M. Saif, Ali Abdo Mohammed Al-kubati, Abdultawab Saif Hazaa and Mohammed Al Moraish "Image Segmentation using Edge Detection and Threshold" The 13th International Arab Conference on Information Technology (ACIT), ISSN:1812-0857, pp.10-13, Dec. 2012.