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A Survey On Intracranial Tumor Detection In MRI Using Various Computer Based Imaging Techniques.

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ABSTRACT

The brain is an organ that serves as the core of the nervous system which maintains the body balance and sensory organs. The periphery of the brain consists of areas are grey matter darker in color which is isolated by neighborhood cells called white matter lighter in color. The harmful tissue growth in brain causes severe symptoms in the individual called tumor. Magnetic Resonance Image is a standard mobility used in medical diagnosis practice. Due to increased medical data flow, the accurate detection of cancerous cells from the Magnetic Resonance Image slices becomes a fastidious task to perform. Image processing techniques are very useful for medical imaging. The processes like pre-processing and post-processing are implemented using numerous algorithmic approaches for detection and segmentation. This paper reviewed about the significance and also drawbacks of various imaging techniques.

Keywords: brain tumor, Magnetic Resonance Image, tumor region, detection, segmentation, automated, clustering, centroids, etc.

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INTRODUCTION

A group of antidromic cell development in the brain or spinal cord led to brain tumor. Tumors categorized in to two main divisions by their nature of growth as cancerous cell called malignant and non-cancerous cell called benign. Benign is a primary stage which has certain limited growth and do not extend. Malignant is a secondary metasis phase of tumor which developed in any parts of our body and extended over brain which grows drastically. Such severe ailment can be found out by MRI or CT [1]. MRI can better than CT due to high intensity and non-invasive [2]. But MRI can't identify the tumor present in deeper portion of brain. So imaging techniques are implement using enormous algorithm and method like segmentation and classification. By processing the image obtained from MRI, we can find the location of tumor regions and also in which stage tumor present inside the brain or spinal cord.

PHASES INVOLVED IN PROCESSING OF BRAIN IMAGES

MRI image is obtained and given as input image. MRI images are not good quality due to patient's head can be moved during MRI scan causes blurred image, external noises. So it is needed to process the image. In pre-processing phase, the colored image is converted to grayscale image using averaging method and weighted method (luminosity method). Image smoothing technique process involved in removing noise from various sources and also image is enhanced using various filtering techniques like median filter, high pass filter, Gaussian filter, diffusion filter. Texture modification and image enhancement also carried out in this phase. Segmentation phase includes segmentation operation applied to a filtered image for obtaining the segmented portion of brain parts to identify the tumor cells. In Post-processing stage many extraction processes are carried out using techniques like thresholding, histogram, morphological operation (includes dilation and erosion). In boundary detection phase tumor portion is marked by box using the boundary box property like rectangle, square and the box can be highlighted using various colors which can be useful for the doctors to easily spot the location of tumors. The output is obtained, which can be examined by the oncologist.

LITERATURE SURVEY

Shivakumarswamy et al [3] in 2016 demonstrated a new technique for detection and sending detected brain tumor information over GSM. The gained outcome from the processed image is transferred to the registered mobile phone as a message. The information contains the location and stage of tumor cells, also sends the presence of tumor in the brain or not. The author employed two most widely used algorithms: K-means clustering [4, 5] and Fuzzy C-means segmentation [6]. K-means clustering process groups the similar data points to the cluster which can be identified by the same clusterID and also reduces the distance between the data points. The algorithm mainly depends on the initial centroids, if the centroids value is same or equivalent to the cluster segments then it is grouped to that cluster. In fuzzy C-means segmentation, the background distortion of the image which is processed by K-means clustering is removed [7]. In this algorithm, partial member grouped value is allocated for each pixels in the image. Then the resultant image undergoes threshold process and binary mask process is applied to the image. Binarization method is applied to the image for detecting the area of the tumor. After detection, the obtained information is transferred over phone. The components such as microcontroller 8051, LCD display, relay circuit, GSM interface are used. Stage and location of tumor in brain is updated to phone which makes free from inaccuracy and human interference. Hence, some drawbacks like more time consumption in iteration process of K-means clustering.

Laszlo szilagyi et al [8] in 2015 proposed a Fuzzy C-means cascaded algorithm for automatic brain tumor segmentation. It is implemented in two steps: First, healthy brain tissues are decimated; in second stage, location of brain tumor tissues is extracted. Here dice score is applied to achieve accuracy in the range of 0.7 to 0.9. The homogenous areas in brain are extracted using FCM (Fuzzy C-means) cascade algorithm [9]. The cluster models in the areas represents there is a numerous input data in the nearby pixels. For accurate clustering, the exact accretion points in the 4D color space. The input image can't be computed because there is more number of clusters due to increased number of iterative computation. To keep away this case, FCM cascaded approach is applied which decimates the non-tumorous portion. The tumor cells are taking apart from normal cells by analyzing the cluster samples.

Yehualashet Megersa et al [10] in 2015 presented a hybrid intelligent algorithm to reduce and rectify the non-homogeneity error occurs in MRI images. A bicubic sphine method is applied with local entropy minimization. The external noise is removed by providing anisotropic diffusion filter. By applying various logical operations on the binarised images, skull stripped brain image is achieved. Four steps are followed in skull stripping method: initialize the threshold value from Otsu's threshold selection technique for image binarisation . Morphological opening is used to detach the narrow connected tissues. Here largest connected shapes only used because brain is bulkily attached structures inside the head. Filling holes using erosion is processed on binarised image. The drawback of this algorithm can't distinguish the type of tumor from healthy ones.

Praveen G.B. et al [11] in 2015 demonstrated a hybrid approach. A fusion of region based and texture based processes are used for detection and classification of brain tumor. The steps carried out in this algorithm are, firstly segment the neoplasm to separate the skull from image. The affected cells are recognized and classified using symmetry property. FBB (Fast Bounding Box) [12] is a swift, segmentation process for detecting the region of tumors efficiently. The proposed system has following steps: pre-processing, feature extraction [13], classification and segmentation. SVM (Support Vector Machine) is used for classification which is a supervised classification models used in learning algorithm. SVM achieves a moderate accuracy due its limited speed and size for training and testing.

U.Vanitha et al [14] in 2015 implemented morphological processing techniques on MRI images. The most widely used operators in this processing are dilation and erosion. But the erosion operator has some drawbacks like exact shape of the tumor cells. If the tumor is round, then tumor cell portion is obtained.

Naveen Kaur et al [15] in 2014 developed a algorithm which depends on gradient differential to spot the tumor cells. It also eliminates the healthy part of brain which doesn't supports high intensity and high entropy. In morphological operation, the image is reconstructed by regional maxima technique. By using the upper and lower threshold values in processing invading blur, noises due to signal distortion are removed. The tumor part is extracted and the time consumed for processing is 3.99 seconds. The nastiest thing is that boundary detection depends on intensity and entropy only.

Charutha S et al [16] in 2014 developed a cellular automata based edge detection is implemented. Moore neighborhood model is applied to cellular automata. This model makes that cell depends on 8 neighbors and there will be 512 patterns. For analyzing the cells, it undergoes situations like loneliness, overpopulation, happiness condition, reproduction. The pre-processed image is transformed in to binary. White pixels are marked as Healthy cells; Black pixels are marked as Dead cells. Hence this followed by binary form 0 (black pixels) and 1 (white pixels). Nearby pixels in the image is calculated. If the intensity values between the normal and tumor cell is less then we can't identify normal and affected one. But it gives exact portion of tumor cells.

Anthony Bianchi et al [17] in 2013 presented a decision forest voxel classifier which reduces the drawbacks occurs due to overlapping of tissue's intensity and shapeless tumor areas. The steps involved are, first locate the gradient effectively. LBP (Local Binary Patterns) and TOP (Three Orthogonal Planes) is used for texture feature extractions to significantly provide accuracy for classifier. Then classes of tissue are found out by improved symmetric texture and symmetric intensity.

Saptalakar B.K. et al [18] demonstrated a segmentation and extraction process for tumor identification. The gap between tumor cell and its district are filled by operators. Here watershed algorithm is used for segmentation and hemispheric part identification is done by detection techniques.

V.P. Gladis Pushpa Rathi et al [19] showed a feature selection process for tumor identification. Support Vector Machine (SVM) can be used by continuous training and non-continuous training processes [20, 21]. It provides a good accuracy by making use of correlation operation. By collecting a class variable, feature selection process provides additional information. The components used here are reduced due to PCA classifier where it lists the decreased features for extraction techniques.

K.Somasundram et al [22] in 2010 depicts the binary image, head mask, brain portion 3-labeled image are generated using bi-level thresholding for feature extraction. In this segmentation process it includes

morphological operator called binary erosion technique, binary dilation are implemented. Here the author analyzed T1-weighted MRI scans. 3-labeled images are generated by assigning label 0 for background; label 1 represents scalp and brain; then for skull and cerebro spinal fluid label 3 is allocated. In brain mask, the similar indices are determined by using Jaccard coefficient where gives good results. But we can't find out the weaker portion due to narrow opening in head or skull. Dice coefficient is used to examine the performance of the algorithms used for processing the image from MRI scans.

Table 1: OVERVIEW OF EXISTING MEHODS

S.No	Author	Year	Pre-processing	Segmentation	Feature Extraction	Classification
1	Shivakumarswamy et al	2016	Median filter	K-means clustering/ Fuzzy C-means technique	Threshold method	-
2	Laszlo szilagyi et al	2015	Noise removal/grayscale conversion	Fuzzy C-means cascade process	-	-
3	Yehualashet Megersa et al	2015	Skull stripping	FCM / Hopfield neural network	Symmetry plane extraction	-
4	Praveen G.B. et al	2015	Median filter	Fast Bounding Box	-	SVM classifier
5	U.Vanitha et al	2015	Contrast adjustment	Erosion	Thresholding	-
6	Naveen Kaur et al	2014	Median filter	Gradient diffusion	-	-
7	Charutha S et al	2014	Median filter	Region based /Cellular automata edge detection	-	-
8	Anthony Bianchi et al	2013	High pass filter	-	Symmetry texture/intensity	Decision forest voxel classifier
9	Saptalakar B.K. et al	2013	Gray scale conversion	-	Thresholding/High pass filter	Morphological process
10	V.P. Gladis Pushpa Rathi et al	2012	Normalization	-	Feature extraction based on intensity	Non-linear Support Vector Machine
11	K.Somasundram et al	2011	Weighted median filter	Binary erosion	Bi-level thresholding	-

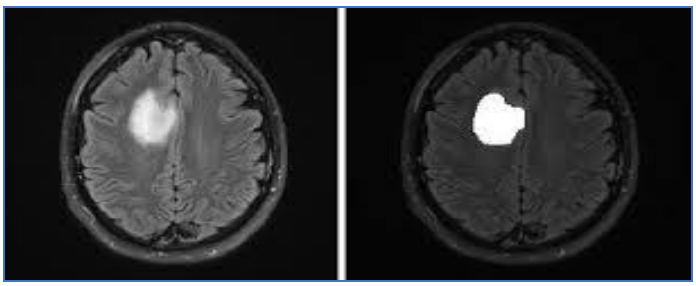

Fig 1: MRI brain image and Presence of brain tumor from processed MRI image

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CONCLUSION AND FUTURE SCOPE

This paper reviewed a various techniques for segmentation and extraction for spot the tumorous cells. From table 1, clearly showed a variety of techniques like segmentation, feature extraction and classification are portrayed. These processes improve the accuracy of detection and also to increase the quality of the image to differentiate the cancerous and non-cancerous cells. Future approach follows a reduced time complexity due to iterative process.

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