A REVIEW OF VARIOUS ALGORITHMS IN BRAIN TUMOR SEGMENTATION

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Abstract: Brain is the most vital and indispensable organ of the human body. The control and coordination of the various crucial structures is completed by the brain. The tumor is shaped by the uncontrolled increase of cell segmentation. A few strategies were created to identify and portion the brain tumor utilizing a few segmentation calculations, for example, 1) watershed calculation, 2) k-implies grouping, 3) Fuzzy c-implies bunching is completed. This is the successful calculation where segmentation of tumor is done and its highlights, for example, centroid, edge and zone are determined from the sectioned tumor. To recognize the brain tumor, examined MRI Images are given as the info. The work required here causes in restorative field to recognize tumor and its highlights helps in giving the treatment procedure to the patient**.**

Index Terms - Brain Tumor, Classification Algorithms.

I. INTRODUCTION

Today there is an increase in interest for setting up of an Automatic Medical Imaging system that can screen a large number of people for life threatening diseases, such as cancer and brain tumor. Brain is one of the vital organs in the human body, which consists of billions of cells. The abnormal group of cell is formed from the uncontrolled division of cells, which is also called as tumor. Brain tumor are divided into two types such low grade (grade1 and grade2) and high grade (grade3 and grade4) tumor. Low grade brain tumor is called as benign. Similarly, the high grade tumor is also called as malignant. Benign tumor is not cancerous tumor. Hence it doesn't spread other parts of the body. However, the malignant tumor is a cancerous tumor, it spreads rapidly with indefinite boundaries to other region of the body easily. It leads to immediate death.

Medical image processing plays a key role in analyzing images acquired through different Image diagnostic methods. Image enhancement and segmentation methods stand at the leading position in digital image processing (DIP) applications.

MR sequences:

Magnetic Resonance Imaging (MRI) is regularly utilized for brain tumor examination and investigation. An assortment of MR arrangements exists, where every one of them is reasonable for various imaging reason. These days, it is a typical practice in programmed investigation to utilize a blend of a few MR successions to accomplish increasingly important and exact outcomes. In this work, three diverse MR successions, to be specific T1-weighted images, T2-weighted images, and FLAIR images, are utilized and they will be portrayed in a matter of seconds as depicted.

T1-weighted image:

In MRI, T1 alludes to the time that protons inside a tissue need to come back to the underlying polarization state, which is given by the static attractive field. Straightforward T1-weighted images (in the blink of an eye T1 images) give preferable anatomical subtleties over T2-weighted images however they for the most part don't bring fascinating data when brain tumor is researched. Be that as it may, they are utilized in a blend with differentiation operator liquid, which is infused into patient's vascular framework. The difference operator features the blood stream in T1-weighted images.

T2-weighted image:

T2 refers to the time that protons perturbed into coherent oscillation by radiofrequency pulse require to lose this coherence. T2-weighted images (shortly T2 images) are, compared to T1 images, more sensitive to the content of water and, therefore, to the pathology, which, as well as cerebrospinal fluid (CSF), appears hyper-intense here.

FLAIR image:

Fluid-attenuated inversion recovery (FLAIR) is a succession that can stifle liquids and it is utilized to smother CSF in brain imaging. This impact empowers to recognize sores, which remains hyper-exceptional as in T2 images, from CSF which moves toward becoming hypo-serious here. Therefore, it is ordinarily utilized in the brain tumor imaging. A correlation between T1, T1C, T2 and FLAIR images with tumor present is delineated in Fig. 1.1. Note the hyper-intense dynamic tumor in T1C images, hyper exceptional tumor in T2 and FLAIR images, and hypo-intense CSF in FLAIR images. In MR Images, it is sometimes difficult to differentiate between specific tissues and cells from the rest of the image. Hence, Image Segmentation is used - manually or automatically partitioning the image into a set of relatively homogeneous regions

with similar properties. The process of image segmentation, help radiologists in finding tumors more accurately. Hence, it is increasingly becoming an important step in medical image processing. Manual process of image segmentation is time consuming and quite difficult for large amount of MR images. Therefore, automatic process of segmentation of MR images is required for above mentioned reasons. From among the several researches which have been done on brain tumor segmentation by using various techniques, this paper has gone through the following literatures shown in TABLE.

II. EXISTING LITERATURE:

Following TABLE describes the brief introduction with advantages and comments of several significant researches have been done in the recent years.

TABLE: Existing literatures with advantages and comments

Ref.	Technique	Advantage	Comment
[1]	Segmentation/tumor detection, comparison of Gabor and Statistical features using various Classifiers (SVM , K-NN)	• In a single contrast mechanism that effectively segments brain tumor tissues with high precision and low calculation complexity. • Statistical features normally provide higher accuracy and have much smaller dimensionality. • In this method no prior anatomical knowledge is required and there is no need for initial assumptions.	• In the comparison between the Gabor wavelet and statistical characteristics, in the automatic segmentation of brain tumor lesions in MRI images, the results show that statistical characteristics are usually more accurate than the characteristics of the Gabor wavelet. Furthermore, the statistical characteristics have a lower dimensionality than the Gabor wavelet-based function.
[2]	Sobel edge detection algorithm, closed contour algorithm, thresholding etc.	• Better version of Sobel edge detection for brain tumor segmentation of MR image has been used in this paper,. The edges generated by this method have lesser false edges and have closed contours. • The segmented images of brain tumors using this method are better compared to tumors removed by normal Sobel edge detection.	• There is room for improvement for the closed contour algorithm to increase the region area and decrease the borderline lines thickness of regions.
[3]	Segmentation, Texture feature, Support vector machine (SVM), Ensemble base classifier.	• In this method, exceptionally good results are achieved. • Accuracy of classification achieved is more than99%. • Achieved very accurate results of segmentation which effectively extract the tumor region from brain MR images.	• Future of this research is measuring the thickness and tumor area of the tumor extracted region.
[4]	Super-pixel, Extremely randomized Tree(ERT), SVM, Gabor Texton feature	• This paper proposes a completely automatic method to detect and segment the brain tumor from FLAIR MRI images by, computing the Gabor text function, fractal analysis, curvature and statistical intensity characteristics from super-pixels. • The formation of super-pixel by grouping voxels with similar properties and extracting features from super pixels improves the accuracy of feature extraction, mainly for the super-pixels near the boundaries between different tissues. It also reduces the computation time, compared to Voxel based feature calculation and classification.	• Super-pixel based extremely randomized trees in FLAIR can also work on T1 and T2 type images as author mentioned. But that is not implemented in the work. In future it can be implemented easily.

[5]	Automatic segmentation using deep learning method(Convolutional Neural Networks (CNNs))	• Automatic segmentation using deep learning method is popular because this method has achieved the state-of-art results. • Deep learning methods can also enable efficient processing and objective evaluation of the huge amount of MRI-based images. • In comparison to traditional automatic glioma segmentation methods, convolutional neural networks(CNN) have the advantage of automatically learning representative complex features for both healthy brain tissues and tumor tissues directly from the multi-modal MRI images.	• Future improvements and modifications in CNN architectures and addition of complementary information from other imaging modalities eg-Positron Emission Tomography (PET), Magnetic Resonance Spectroscopy (MRS) and Diffusion Tensor Imaging (DTI) may improve the current methods, eventually leading to the development of clinically acceptable automatic glioma segmentation methods for better diagnosis.
[6]	Intensity and patch normalization, Convolution neural network based classifier, Deep learning method	• In this paper using intensity normalization achieved good segmentation. • Brain tumor is very inconsistent in their spatial localization and structural configuration so in this paper data augmentation is used to manage with such variability.	• Here the researchers proposed new techniques based on CNN to segment the brain tumors in MRI images and during the design of their method, they have addressed the heterogeneity caused through the acquisition of MR images with multiple scanners in multiple sites using intensity normalization.
[7]	Fuzzy-C-Means, Anisotropic diffusion filtering technique	• In this paper, the pre-processed output image is segmented using the Fuzzy C-Means algorithm, which is efficient and generates good results. • Average dice coefficient obtained was .729 which gives the efficient segmentation and detection of brain tumor in MR images.	• In Future circularity criteria may be used with other feature extraction technique to enhance its efficiency.
[8]	Adaboost classifier, Anistropic diffusion filtering, Edge detection, Stationary wavelet transform	• In this paper Implementation result gives 100% accuracy on 155 MR images. • This system provides automated system with better accuracy in minimum time for detecting a tumor.	• Wavelet decomposition should be done with more depth layers. More MRI data should be analyzed.
[9]	K-means algorithm, Object labeling algorithm, SVM	• This system used object labeling algorithm to obtain detailed information about tumor area. • This system gives adaptive brain tumor detection. For making adaptive this system used SVM as Unsupervised manner so it gives good result in comparatively other existing method.	• Further Scope of the brain tumor detection and segmentation system is that if there is three-dimensional image of the brain with the tumor, then the tumor size, tumor type and the stage of the tumor can be found.
[10]	Convolution neural network	• This system has achieved high performance using a new two-way architecture (which can represent both local and global information) and representing local label dependencies by arranging two CNNs.	• In the BRATS challenges this technique is One of the most accurate methods available, although very computationally efficient.

CONCLUSION:

Image Processing assumes dynamic job in today's world. Presently day the utilizations of image processing can be found in territories like hardware, remote detecting, bio-restorative, etc. On the off chance that we center bio-therapeutic applications, Image handling is generally utilized for finding of various tissues reason. By utilization of proper Image segmentation strategy and utilization of precise info Image is vital. In this paper different existing segmentation methods for brain (MRI) Magnetic Resonance imaging have been talked about. Image segmentation has a promising future as the all-inclusive segmentation calculation. As the outcome, Image segmentation is influenced by loads of components, for example, comparability of Images, spatial attributes of the Image coherence, surface and Image content. In this work, different procedures of Image segmentation has been talked about, a diagram of some related Image segmentation methods has been displayed. The fundamental Image segmentation calculations and characterization of Image segmentation are talked about. In this investigation, the review of different segmentation strategies connected for advanced image Processing clarify quickly.

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