Brain Tumor Detection With Chain-Vese Segmentation Using Morphological Opretions & Ansidoff-Filter

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Abstract- *image processing plays an important role in medical field and medical imaging is a growing and challenging field. Medical imaging is advantageous in diagnosis of the disease. Many people suffer from brain tumor, it is a serious and dangerous disease. Medical imaging provides proper diagnosis of brain tumor. There are many techniques to detect brain tumor from MRI images. These methods face challenges like finding the location and size of the tumor. To detect the tumor from the brain is most important and difficult part, image segmentation is used for this. Already, various algorithms are developed for image segmentation. In this review paper we cover the basic terminologies of brain tumor and MRI images we also uses median filter to filter the brain mri image and classify the brain image using different types of kernals.chainvese segmentation ,we also use chain-vese segmentation to ease and reduce the time of segmentation.*

Keywords- Image Segmentation , Brain Tumor Detection , Mathematical Morphological Reconstruction , Magnetic resonance imaging (MRI) CLAHE, Ansidofffilter, SVM, Morphological opretions, Chain-Vese Segmentation,

I. INTRODUCTION

Image processing is a technique to translate an image into digital form and execute some operation on it, in order to get an improved image or to retrieve useful data from image. It is a procedure of signal distribution. The process takes input as an image and then apply efficient algorithms, and the results may be image, data or features associated with that image. The processing stages start with image segmentation. There is some desire from image segmentation algorithms. first of them is speed. While processing for segmentations of an image, it does not want to spend much time. The second is good shape integration of the object. This will enhance results in picture acknowledgment. If the result of shape is incomplete, it need to take many properties to record the edge of the over-section results.

Image segmentation is a procedure, which split a picture, which are comparative in some viewpoint and change over it into paired frame for preparing. Segmentation process is the primary step in many image processing. Procedure incorporates object characteristic and portrayal and detail estimation. Higher request errand takes after the grouping of object. Hence, classification, imagining of region of interest in any image, description plays a substantial role in image segmentation. There are numerous segmentation algorithms available in the literature, which split an image into number of regions based on some picture attributes like pixel quality esteem, shading, color, shape etc. These all calculations are described based on the segmentation strategy utilized. Segmentation method split the region using different method such as single or multiple thresh holding, segmentation on parallel region, segmentation using clustering, edge detection, and also segmentation on fuzzy logic technique etc [1].

Brain tumor is a growth of abnormal tissues inside the brain. It causes pressure in skull region and affects the normal functioning of brain As per the survey has done the highest death rate in the world is due to a brain tumor. Symptoms include changes in the hormones, blood clots, weakness, uncontrolled walking, muddled speech, mood swings, loss in vision, etc. The location of the tumor defines its type, and its proper diagnosis can save the life of the patient. Benign tumors are non-cancerous growths in the body that cannot invade neighboring tissue. They can be completely removed and are unlikely to reappear. Benign brain tumors do not spread to adjacent tissue; however, they can cause significant pain, lasting brain damage, and death. Malignant brain tumors have no distinct limits. They grow quickly, creating increasing pressure within the brain, and can also diffuse throughout the brain or spinal cord beyond their point of origin. It is extremely rare for a malignant brain tumor to spread outside the brain [2].

Brain is the center of human central nervous system. The brain is a complex organ as it contains 50-100 billions

neurons forming a gigantic network. A brain tumor is a mass of unnecessary and abnormal cell growing in the brain or it can be defined as an intracranial lesion which occupies space within the skull and tends to cause a rise in intracranial pressure. Brain tumors are mainly classified into two i.e. Benign and Malignant. Benign tumors are noncancerous and they seldom grows back where as malignant tumors are cancerous and they rapidly grows and invade to the surrounding healthy brain tissue.

Magnetic resonance imaging (MRI) is high-quality medical imaging, particularly for brain imaging. MRI inside the human body is helpful to see the level of detail. Doctors have major technical and economic importance of reliable and fast detection and classification of brain cancer, based on common practices. Most of the technicians are slow, less responsible, and that's hard to quantify possess a degree of subjectivity. Detection of brain tumor from MRI images involves various Phases such as Preprocessing, Feature extraction, Segmentation and classification.

MRI Image segmentation is based on set of process of brain tumor detection; pixel intensity based features are extracted. Image Segmentation group pixels into regions and hence defines the object regions. Segmentation uses the features extracted from image. Classification is the last step in process of brain tumor image into normal or abnormal and classifies the abnormality type whether it is benign or malignant. This study evaluates various techniques which are used in tumor detection from brain MRI [3].

MRI is commonly used in the medical field for detection and visualization of details in the internal structure of the body. It is basically used to detect the differences in the body tissues which have a considerably better technique as compared to computed tomography . Thus, this technique become a special technique especially for the brain tumor detection and cancer imaging. Basically, for comparison, CT uses ionizing radiation while MRI uses strong magnetic field to align the nuclear magnetization that follows by changes the alignment of the magnetization by radio frequencies that can be detected by the scanner. The signal produced can be further processed later to gain extra information of the body [4].

Mathematical Morphology is developed from set theory. Morphology was originally developed for binary images, and was shortly extended to grayscale functions and images. Morphology is a broad set of image processing, process that process images supported on shapes [4]. Morphology is most commonly applied to digital images, but it can be employed as well on graphs, meshes, solids, and many other spatial structures. Mathematical morphology is a way of nonlinear filters, which could be used for image processing as well as noise suppression, feature extraction, edge detection, image segmentation, shape recognition, texture analysis, image restoration and reconstruction, image compression etc. Mathematical morphology provides an approach to the processing of digital images which is based on shapes [5].

Mathematical morphology constitutes a well defined framework for non-linear image processing based on set relations. It relies on minimum and maximum values over neighborhoods (i.e. regions surrounding the individual points) defined by shapes or functions known as structuring elements. Classical morphological operations use a predefined structuring element which is used repeatedly for each point in the image. This is often not ideal, however, which has motivated the evolution of adaptive morphological filtering where the structuring element changes from point to point. The field of adaptive mathematical morphology includes many different concepts with different strengths and weaknesses, and the specific choice of method should be made with the specific application in mind [6].

II. LITERATURE REVIEW

Hashemzehi, R., et al. [2020] A brain tumor is an abnormal growth of cells inside the skull. Malignant brain tumors are among the most dreadful types of cancer with direct consequences such as cognitive decline and poor quality of life. Analyzing magnetic resonance imaging (MRI) is a popular technique for brain tumor detection. In this paper, we use these images to train our new hybrid paradigm which consists of a neural autoregressive distribution estimation (NADE) and a convolutional neural network (CNN). We subsequently test this model with 3064 T1-weighted contrast-enhanced images with three types of brain tumors. The results demonstrate that the hybrid CNN-NADE has a high classification performance as regards the availability of medical images are limited [7].

Chandra, S. K., & Bajpai, M. K. (2020) Benign brain tumor is early stage of cancer in tumor development life cycle. Its detection is hard and most challenging task due to low variability with its surrounding non-cancerous tumor cells. Image segmentation is used as a primary tool in brain tumor detection algorithms to segment the tumorous region. Current work proposes a novelfractional method for finding such a low intensity variational region. The proposed method uses alternate direction implicit finite difference scheme. The performance analysis has been done on three-dimensional numerical head phantom and BRATS dataset. Results obtained by the proposed tumor detection and segmentation

method have been compared with the popular tumor detection and segmentation methods. Hausdorff distance, Jaccard similarity index and Dice coefficient have been used for quantitative comparative performance analysis [8].

Wu, M. Y., et al. [2020] In this study, previously acquired experimental data, including surface fracture image and fluid pressure curve, were used for modelling and comparison. Employing digital core reconstruction and the combined finite-discrete element method, A process of modelling crack geological model was proposed based on the rock surface sketch after fracturing. Two-dimensional models were established according to the surface fracture morphology of specimens. The initiation and propagation pressures are positively related to the elastic modulus in the fluid pressure evolution. The crack geological model proposed in this study provides direct guidance for crack reconstruction in simulations. Moreover, the research results may provide a guidance for studies on the evolution of hydraulic fracture under the influence of rock heterogeneity [9].

Toğaçar, M., Ergen, B., & Cömert, Z. (2019) A brain tumor is a mass that grows unevenly in the brain and directly affects human life. In this study, we propose a new convolutional neural network model named BrainMRNet. Attention modules select important areas of the image and the image is transferred to convolutional layers. One of the most important techniques that the BrainMRNet model uses in the convolutional layers is hypercolumn. The aim is to select the best and the most efficient features among the features maintained in the array. Accessible magnetic resonance images were used to detect brain tumor with the BrainMRNet model. BrainMRNet model is more successful than the pre-trained convolutional neural network models (AlexNet, GoogleNet, VGG-16) used in this study. The classification success achieved with the BrainMRNet model was 96.05% [10].

Bala Maalinii, G., & Jatti, A. (2018) This paper presents a methodology to identify and segment brain tumour using Morphology based Reconstruction and Thresholding in Magnetic Resonance (MR) images. Novelty remains in using opening and closing by reconstruction to segment brain tumour which reduces the algorithm size considerably. MR images of brain are given as input to the algorithm. Brain tumour has been extracted and size of tumour is measured in terms of number of pixels. As a concluding work, four MR images have been tested using the proposed method. Based on the results it can be concluded that the proposed method is effective in extracting tumour 11].

Devkota, B., et al. [2018] This study proposes a computer aided detection approach to diagnose brain tumor in its early stage using Mathematical Morphological Reconstruction (MMR). A large number of textural and statistical features are extracted from the segmented image to classify whether the brain tumor in the image is benign or malignant. Experimental results show that the segmented images have a high accuracy while substantially reducing the computation time. The study shows that the proposed solution can be used to diagnose brain tumor in patients with a high success rate [12].

Sumathi, R., et al. [2018] The proposed method yields 97% accuracy in the identification of the exact topographical location of tumor region. It requires less computational time (about 3 milliseconds, on average) for processing. Thus the proposed method can help radiologists quickly detect the exact topographical location of tumor regions even when there are severe intensity variations and poor boundaries. The method fares well in terms also of other standard comparison metrics like entropy, eccentricity, Jaccard Index, Hausdorff distance, MSE, PSNR, precision, recall and accuracy, when compared to the existing methods including Fuzzy C Means clustering and PSO. Above all, the algorithm developed can detect the tumor regions in the MR images of both brain and breast. The method is validated using various types of MR images (T1, T2 for MRI brain, and T1 post contrast and post processed images for breast) available in the online datasets of BRATS, RIDER and Harvard [14].

Gupta, N., & Khanna, P. (2017) The detection of brain tumor is a challenging task for radiologists as brain is the most complicated and complex organ. This work presents a non-invasive and adaptive method for detection of tumor from T2-weighted brain magnetic resonance (MR) images. Several textural and shape features are extracted from the segmented image and two prominent ones are selected through entropy measure. Support vector machine (SVM) classifies MR images using prominent features. Experiments are performed on a dataset collected from MP MRI & CT Scan Centre at NSCB Medical College Jabalpur and the other from Charak Diagnostic & Research Centre Jabalpur. More than 98% accuracy is reported with 100% sensitivity for both the datasets at 99% confidence interval. The proposed system is compared with several existing methods to showcase its efficacy [15].

III. RESEARCH WORK

A. PROPOSED METHODOLOGY

In our propose method we use CLAHE and chain-vesesegmentaion .CLAHE is the enhanced version of adapted

histogram in the base code to improve the contras and we uses the chain-vesesegmentaion. CLAHE uses contrast amplification limiting procedure that is applied for each neighbouring pixel which then forms a transformation function in order to reduce the noise problem. The anisotropic diffusion approaches may also differ through the way they choose the diffusivity conductance. Anisotropic diffusion smoothing is a well-established paradigm in digital image smoothing with edge preservation. SVM was proposed first by Vapnik and has since become highly concerned with the research community of machine learning.

B. PROPOSED TECHNIQUES

1. Support Vector Machine (SVM)

SVM was proposed first by Vapnik and has since become highly concerned with the research community of machine learning. Several recent experiments have shown that SVM is typically able to provide better classification accuracy efficiency than other data-classification algorithms. Sims is used in a broad variety of real-world issues, such as categorizing documents, hand-written visual identification, toning, image description and object-detection, data processing for microarray gene expression. Sims has also been preferable to other controlled forms of learning. The output of SVM for certain datasets is highly responsive to how parameters of costs & kernels are configured. It allows users to undertake thorough cross-validation to establish optimum parameters.. [16].

2. Contrast Limited Adaptive Histogram Equalization

CLAHE is an advanced form of AHE. It prevents the over amplification of noise which results in AHE technique. CLAHE uses contrast amplification limiting procedure that is applied for each neighbouring pixel which then forms a transformation function in order to reduce the noise problem. Contrast-Limited Adaptive histogram equalization algorithm is the combination of limited contrast approach with adaptive. CLAHE algorithm is used to enhance an image for better quality and to remove the noise. It provides the expensive computation complexity for night image. CLAHE is a refinement of AHE where the enhancement calculation is modified by imposing a user specified level to the height of local histogram. [17].

3. Anisotropic Diffusion Filtering

In Image Processing and Computer Vision, preprocessing is necessary, because various types of noises are superimposed during image or vision formation. To remove highly robust noises, the anisotropic filtering process in one solution. Anisotropic diffusion also called Perona–Malik diffusion, is a technique aiming at reducing image noise without removing significant parts of the image content, typically edges, lines or other details that are important for the interpretation of the medical image. diffusion resembles the process that creates a , where an image generates a parameterized family of successively and more blurred images based on a diffusion process.Anisotropic diffusion is a generalization of this diffusion process; the filter generates a group of bounded images. The output image is obtained with super position of the input image and filtered content of the input image [18].

4. CHAINVESE

Chainvese is used to reduce the segmentation time and It will ease the segmentation process and we are using different SVM kernels to compare the accuracy of the detection and PNSR for the comparison of the image.

B. PROPOSED Algorithm

Algorithm Steps:

Step1: Load the MRI image of the brain
Step2: Apply Anisodiff filter
Step3:opening by reconstruction of the image
Step4:Closing the image using morphological operations
Step5:Chain-Vese segmentation
Step6:segmentation of the image and detection of the tumor
Step 7:get accuracy on different kernals.

C. FLOW CHART

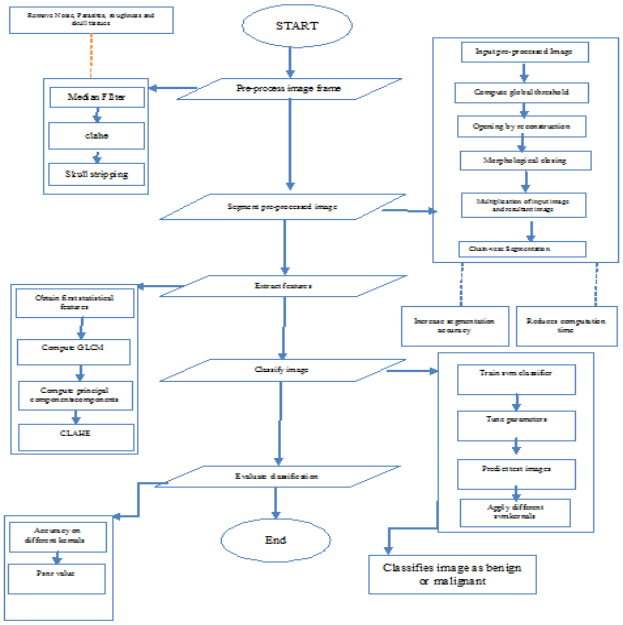


Figure 1.Flow Chart of Porposed model

IV. RESULT ANALYSIS

A. DESCRIPTION

MATLAB 2018 will present the analysis methods chosen for this study. It is a highly qualified language for scientific computing. It integrates a straightforward setting in which . math terminology outlines difficulties and answers in computing, visually visualizing, or programming.

B. SCREENSHOTS OF SIMULATED RESULT

The findings and amount of features selected from current or proposed algos are shown in the figures below.

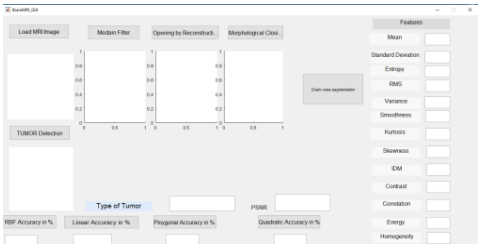


Figure 2: First output when we run the code

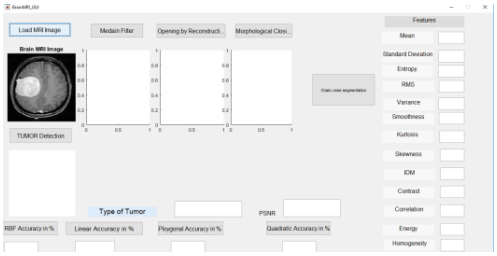


Figure 3: Loading the Mri image

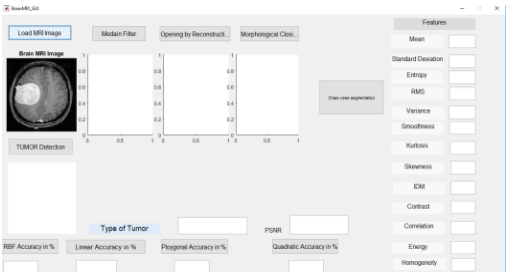


Figure 4: Median filter to remove noise

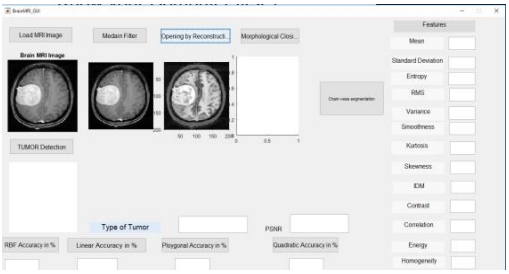


Figure 5: opening by reconstruction

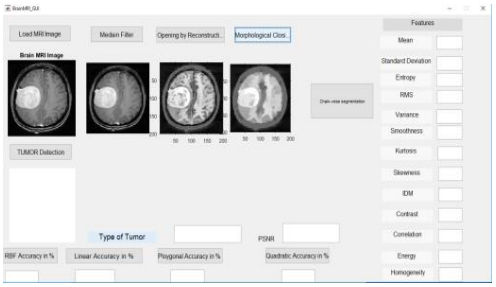


Figure 6: Morphological closing of mri image

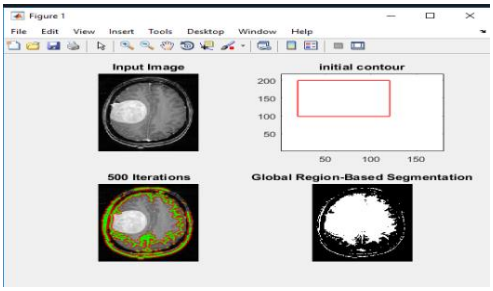


Figure 7: Chain-vese segmentation

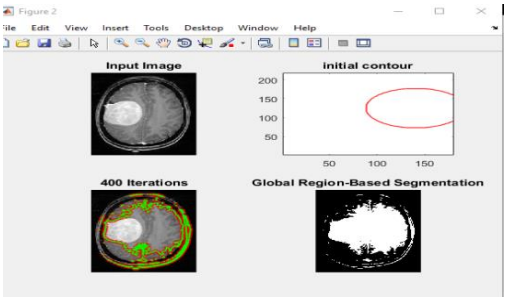


Figure 8: Tumor Detection

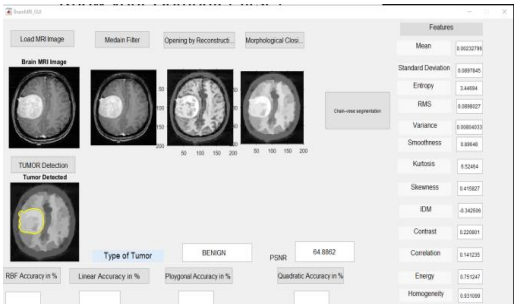
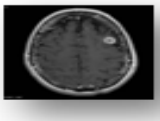
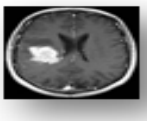
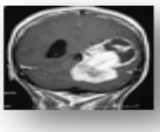
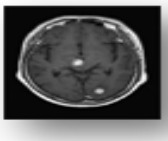
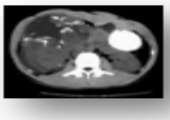
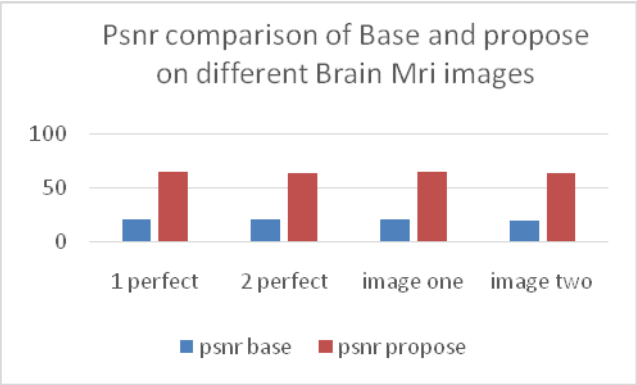


Figure 9: Getting Accuracy using svm

Table 1: Results Description

Image	Type find by program	psnr
	svm detect the tumor as Benign	64.6844
	Svm detect the tumor as malignant	63.3877
	svm detect the tumor as Benign	65.4902
	Svm detect the tumor as malignant	63.4317
	svm detect the tumor as Benign	66.5247



Graph 1: Comparison of Graph Results

Table 1: Comparsion of Base PSNR & Proposed PSNR

Image name	PSNR base	PSNR propose
1 perfect	20.11	65.0249
2 perfect	20.2342	65.7009
Image one	20.1323	67.0685
Image two	19.8401	62.8071

V. CONCLUSION

In this research, A generalized form of adaptive histogram equalization is called as contrast limited adaptive histogram equalization which is also known also known as CLAHE. It was developed to address the problem of noise amplification. CLAHE operates on tiles which are small regions in the image, rather than the entire image. Anisotropic diffusion is posed as a process of minimizing an energy function. Anisotropic diffusion filter is one of the methods which satisfy this need and draws much attention from researchers in the past. By using the propose method we get more accuracy then the base and effective noise reduction by Anisodiff filter as u can see in the results. The detection of brain tumor is very important in the medical world and segment the brain tumor for different medical study and various method is used to segment the brain tumor image and we uses a different approach which have higher psnr and accuracy thus our propose method proves itself better than the other.

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