International Journal of Advances in Engineering and Management (IJAEM)
Volume 3, Issue 1 Jan-Feb 2021, pp: 683-701 www.ijaem.net ISSN: 2395-5252

Design techniques for detection of brain tumor in MRI images

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Submitted: 20-01-2021 Revised: 31-01-2021 Accepted: 03-02-2021

ABSTRACT: In a short period of time,the medical image processing is in increasing demand for systematic and efficient brain tumor detection. Detecting a wide variety of brain images in terms of shape and intensity is a challenging and difficult task.MRI, CT Scan, XRay are various methods of analyzing the area of brain. MRI images of brain can be used to gather information about the brain that helps to find brain anomalies, thus it shows whether the person is suffering from some disease of the brain or not. There are several categories of brain ailments. One of them is development of tumour in the brain. To find the presence of tumour,edge detection technique can be a useful way, yet there are challenges in the method since, intensity of healthy tissue, tumor and surrounding fluids overlap.In this paper the various preprocessing, post processing and methods like Filtering, contrast enhancement, Edge detection and post processing techniques like Histogram,Threshold, Segmentation, Morphological operation for brain tumour detection are discussed.This paper contributes to present existing novel approaches for brain tumor detection.

Keywords: MRI, Image Segmentation, Edge Detection, Brain Tumor.

I.INTRODUCTION

Image processing techniques play an important role in the diseases diagnostics and detection.It also helps monitoring the patients having these diseases. Digital image processing consists of algorithmic processes that transform one image into another in which certain information of interest is highlighted, and the information which is irrelevant to the application is attenuated or eliminated. The majority of hospitals use digital technology system because it can bring users many benefits. The result of diagnosis is dependent on the medical image because doctors often use the image to find out medical problems for patients. Based on the image information, especially object boundaries doctors will build a suitable treatment plan to save their lives. In fact, many patients die due to inaccuracy in diagnosis, which comes from a lack of information in the image because the image has not been processed effectively. Edge detection is one of the important tools in image processing, particularly in the areas of feature detection and feature extraction, which aim at identifying points in a digital image at which the image has discontinuities [3].

II. BRAIN TUMOURS

The cell is considered as the fundamental structural unit of all living organisms. Human body contains about 100 trillion cells and each of them having its own functions. For the proper functioning of the body, these cells have to divide to form new cells in a controllable manner. But sometimes, they divide and grow in uncontrollable manner to form new cells. This results in a tumor which is a mass of unwanted tissue . Tumors can occur in any of the body parts.One of the serious and life- threatening tumors is brain tumour. It is actually created either by the abnormal and uncontrolled cell division inside the brain or from cancers primarily present in other body parts. Generally, classification of brain tumours is based on the location of their origin and its malignancy.

A. Types of tumors

1) They are classified based on the location of the origin of tumors as following:

a) Primary brain tumors: Tumors originating in the brain cells are called as primary brain tumors.,sometimes they spread to other parts of the brain or to the spine. But spreading to other organs occurs very rare.

b) Metastatic brain tumors: Metastatic or secondary brain tumor originates in other parts of the body and then spread to the brain. These tumors are named after the location they originate.

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2) Based on the tumors malignancy originated, they are classified accordingly:

a) Benign brain tumors: Benign tumors are the least aggressive ones. They originate within the brain cells or from associated parts of the brain and they will not contain cancer cells. They grow slowly and also their growth are self-limited and they will not spread into other tissues.

b) Malignant brain tumors: These tumors contain cancerous cells and their growth is not self-limited. Often their borders are not clear and also they grow rapidly and invade surrounding brain tissue. Hence if proper treatment is not taken at the correct time,they will become life threatening.Different types of imaging techniques like magnetic resonance imaging (MRI), computed tomography (CT) etc. exist for the diagnosis of brain tumor. MRI is the most advisable one since it does not uses ionizing radiation and it also provides greater contrast between different soft tissues of the human body.

From the MRI images,Brain tumors can be detected manually by experts . But manual segmentation faces some difficulties such as over-time consumption, chances of variation of results from expert to expert and chances of getting computational error. Different methods are there for semi-automatic detection of brain tumors but they also require human intervention which again makes the process time-consuming and expensive. Here comes the importance of automatic brain tumor detection techniques from the medical images. The automated techniques should be self-explanatory and easy to operate for the radiologists[30]

III. BRAIN MRI IMAGES

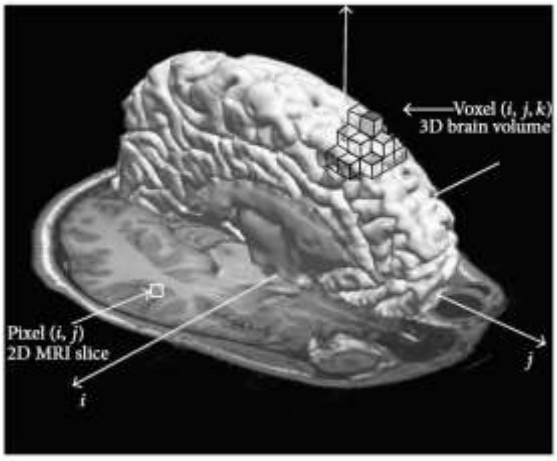

Fig 1: Brain MRI Images

Illustration of image elements in the MRI of the brain is shown in Fig 1. An image pixel (i, j) is represented with the square in the 2D MRI slice and an image voxel (x, y, z) is represented as the cube in 3D space.

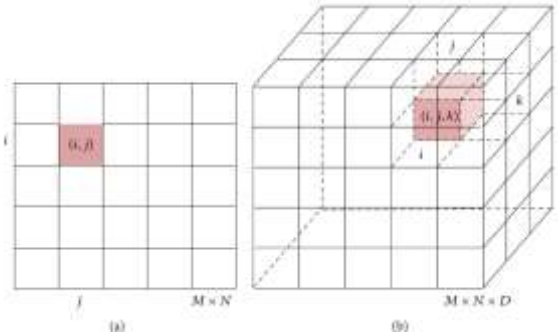

Fig 2: Illustration of image elements in 2D and 3D space. (a) In 2D space image elements (pixels) are represented with lattice nodes depicted as a square. (b) In 3D space image elements (voxels) are represented with lattice nodes depicted as a cube[19].

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Nowadays, magnetic resonance imaging (MRI) is one of the most important imaging technique to obtain a medical image with high contrast. In addition, MRI acquisition device could be controlled to provide different gray levels for different tissues, and it provides higher contrast compared to computerized tomography (CT). MRI scanning is relatively safe and can be used as many times as required. It is based on the hydrogen nucleus due to their abundance amount in the human body and their magnetic resonance sensitivity [14].

IV. BRAIN MRI IMAGE ANALYSIS.

The following information needs to be extracted from the MRI image,to analyze MRI images

1. Analysing the MRI image depending on the intensities of the different region of the image
2. The area pertaining to the several intensities in the image
3. Edge detection of the different areas of the image[15].

V. EDGE DETECTION

To check for any abnormal growth in the brain,edge detection can be a useful technique. The following Fig 3 indicates block diagram of the basic steps edge detection.

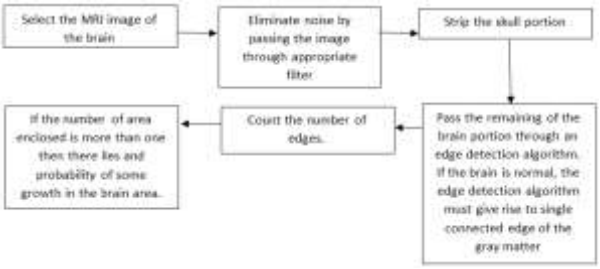

Fig 3:block diagram of the basic steps edge detection[15]

There are many algorithms available for edge detection, but these algorithms face multiple challenges.The challenges faced by edge detection algorithms are as follows

- Due to noise,fake edges are detected
- Detection of real edge points is missed and thereby detecting fake edges.
- Each edge getting multiple responses
- Lighting condition changes
- Dynamic background
- Position of the detected edge shifted from its true location
- Geometrical features [15].

1. Gradient: The gradient method looks for the maximum and minimum in the first derivative of the image to detect the edges. Roberts, Prewitt, Sobel operators works on Gradient method.

In many ways,edge detection can be performed . However, the different methods or the operators used for edge detection can be broadly classified into two categories:

2. Laplacian: The Laplacian method detects zero crossings in the second derivative of the image to find edges and doesnot depend on direction.

Table 1: Summary of different edge detection techniques [33]

Operators	Advantages	Disadvantages
Sobel, Robert	Simplicity, Better noise suppression	Discontinuity in edges, Not accurate result
Prewitt	Mask simpler as compared to Sobel	Discontinuity in edges
Laplacian (Zero Crossing)	Detection of edges and their orientations, Having fixed characteristics in all directions	Noise sensitive
Marr- Hildreth	Simplicity, Accuracy of Zero crossing locations	No edge detection at corners
Canny	Low error rate, Single edge point response	High complexity, Little time consuming compared to others

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VI. IMAGE SEGMENTATION

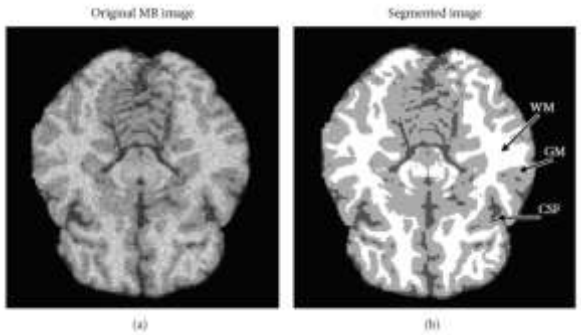

Fig 4:(a)Original MR Image (b)Segmented Image

The goal of image segmentation shown in Fig 4 is to divide an image having similar attributes such as depth, intensity, color, or texture into meaningful, homogeneous, and non-overlapping regions. The segmentation result is either a set of contours describing the region boundaries or an image identifying each homogeneous region.

Fundamental components of structural brain MRI analysis include the specific tissue type classification of MRI data and description of specific anatomical structures. Classification means to assign to each element in the image a tissue class, which are defined in advance. The problems of segmentation and classification are linked with each other because segmentation implies a classification, while a classifier implicitly segments an image.In the case of brain MRI, image elements are typically classified into three main tissue types: white matter (WM), gray matter (GM), and cerebrospinal fluid (CSF)[19]

VII. VARIOUS DE-NOISING FILTERS

We have studied the various filtering techniques in digital image processing, that are shown in Table 2. [21]

Various Filters	**Working Principle**	**Advantages**	**Disadvantages**
Mean Filter	Based on average value of pixels	Reduces Gaussian noise.Response time is fast	Results in distorted Boundaries and edges
Median Filter	Based on the median value of Pixels	Efficient for reducing salt & pepper noise, speckle noise. Boundaries and edges are Preserved	Complex and time consuming as compared to mean filter.
Wiener Filter	Based on inverse filtering in frequency domain	Efficient for removing blurring effects from images	Due to working in Frequency domain, its speed is slow. Doesn't provide good results for speckle noise.
Hybrid Filter	Combination of median and wiener filter	Removes speckle noise,impulse noise and blurring effects from images	Complex and time consuming
Modified hybrid Median Filter	Combination of mean and median Filter	Efficient for removing speckle,salt and pepper and Gaussian noise	Computation time is more as compared to simple median filter
Morphology Based Denoising	Based on Morphological opening and closing Operations	Efficient and Producing better results as compared to other filters	

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VIII. PROBLEM FACED DURING BRAIN MRI SEGMENTATION

Acquired MR images are not perfect and always corrupted by noise and other image artifacts. Various techniques for image segmentation have been developed because of the diversity of image processing applications. This is because there is no single method that can be suitable for all images, nor all methods are equally good for a particular type of image. For example, only the gray level histogram is used in some of the methods and for noisy environments, spatial image information is used. Probabilistic or fuzzy set theoretic approaches are used by some methods, while some additionally integrate prior knowledge (specific image formation model, e.g., MRI brain atlas) to improve the performance of segmentation. However, most of the segmentation methods developed for one type of images can be easily applied/extended to another type of images. For example, the graph cut theory was initially developed for binary images, can be modified and used for MRI segmentation of the brain tissue. Also, unsupervised fuzzy clustering has been successfully applied in different areas such as remote sensing, geology, and medical, biological, and molecular imaging. With application to brain MRI, the segmentation methods may be grouped as follows:

- Manual segmentation
- Intensity-based methods
- Atlas-based methods
- Surface-based methods
- Hybrid segmentation methods.

IX. The survey on the performance of different techniques used in Brain tumour in MRI images.

Ref	Year	Design Methodology and Existing study	Inferences
[1]	2020	This paper presents an algorithm which combines Region of Interest , Region Growing and Morphological Operation .The approximate Region Growing is initially identified in this method. Techniques based on Region growing are better than the edge-based techniques in noisy images where edges are difficult to detect. The Morphological Edge Detection of the input image is done and the input image is reconstructed on the basis of dilation and erosion for the image enhancement. In this proposed work, preprocessing is done to reduce the noise. Fuzzy C-Means is used to Region growing. Morphological edge detection is used to enhance the image. Finally to get the output, Gaussian filter is applied .After that, to detect and segment the tumor from the brain MRI image, Fuzzy C-Means clustering, followed by seeded region growing is applied.	In terms of computation time and segmentation accuracy, the proposed method is effective. Morphological edge detection is focused on the growth rate of tumor and for getting better enhancement of the image. By using shape based feature, area and centroid of the brain tumor region has been found out.
[2]	2020	The proposed work is comprised of three phases i.e preprocessing, edge	This work has provided (99.31%) of brain tumor segmentation accuracy on average using modified watershed segmentation.

		detection and segmentation. At first, the MRI images are extracted from the database and a high pass filter is applied to enhance the image. After completing the preprocessing method, the enhanced canny edge detection approach is used to enhance the image. After that, the images are given to the modified watershed segmentation algorithm to separate the ROI part from MRI Image.	Proposed work is compared with other algorithm to verify the effectiveness of the proposed technique. Similarly, edge detection efficiency also compared with other algorithm. From the results our algorithm produce the better results compare to other algorithm.
[3]	2019	This article concentrates on a noise removal technique and using a balance contrast enhancement technique (BCET) for improvement of medical images . Then, image segmentation is used. Finally, to detect the fine edges,the Canny edge detection method is applied .	The experiment results achieved nearly 98% accuracy in detecting the tumor area and normal brain regions in MRI images which demonstrates the effectiveness of the proposed technique.
[4]	2019	To detect medical MRI Image edge, a modified morphological algorithm is proposed. It is a better compromise method between noise smoothing and edge orientation, but the computation is more complex than general morphological edge detection algorithms.	The experimental results show that the proposed algorithm is more efficient for denoising the medical image and edge detection than the usually used edge detection algorithms such as Robert, Sobel, Prewitt, Canny edge detector and general morphological edge detection algorithm. From the experimental results, we conclude that the proposed algorithm can suppress salt and pepper noise and simultaneously preserve finer edge.
[5]	2019	This technique uses Euclidean distance to detect the age of tumor and also to identify the spreading area of disease. Canny edge detection algorithm and thresholding technique is used in this work.It exploits the information detection of brain tumor source through Magnetic Resonance Image. This system helps in the calculation of the approximate tumor age using Euclidean distance.	The experimental results show that the proposed algorithm is additional noise resilient and improved tumor detection than the existing algorithm.
[6]	2018	In this paper an edge detection algorithm, adjusted specially for processing brain MRI images is used. As the first step of improved	The simulation results show that the proposed algorithm is more noise-resilient and better in edge detection than standard Canny algorithm.

		Canny algorithm,LoG filer was introduced . Also, for edge detection in brain MRI images,gradient magnitude and kernel gradient were adjusted specially.	
[7]	2018	At the first stage, this method includes some functions for noise removal that provides better characteristics of medical images using Balance Contrast Enhancement Technique. Using Fuzzy c-Means clustering method, the result of second stage is subjected to image segmentation. Canny edge detection method is applied to detect the fine edges finally.	The proposed method gives good estimators, which presents high image quality for the analysis by medical specialist. Evaluation of the edge maps by medical expert demonstrated that in some cases of tumor pathology the accuracy of segmentation is better by 10-15% regarding the corresponding expert estimates.
[8]	2018	A robust, quasi high-pass filter is developed for edge detection in medical images.The proposed edge detector has a mathematical form of local variance and is adaptive in nature.	The WL operator is noise-resilient and can efficiently extract crucial edge features contained in object boundaries. The performance of the WL operator was compared to that of other methods and evaluated using Pratt's FOM and VAS. The WL operator outperformed other methods in this study and thus warrants further evaluation.
[9]	2018	This paper proposes a strategy to detect brain tumor edges from patient's brain MRI scan images. This method includes some noise removal functions, followed by improvement features and gain better characteristics of medical images using BCET. The result of second stage is subjected to image segmentation by using Fuzzy c-Means clustering method. Canny edge detection method is applied to detect the fine edges finally.	The experimental results show that proposed methodology is resistive to a noise.Also, an increase in the accuracy of solving the problems of geometric analysis and segmentation, in some cases of tumor pathology, was found to be 10-15% better relative to the corresponding expert estimates.
[10]	2018	This project discussed with pre-processing stage consisting of bias field correction, intensity and patch normalization in CNN-based method for segmentation of brain tumors in MRI images. The MRI images have the problem of intensity	The Brain tumor segmentation using CNN is very efficient method with high accuracy. The edge detection and image enhancement will lead to a wide verity of surgical applications in medical field.

		inhomogeneity This problem is corrected by the N4ITK method, which enables to identify the grey matter, white matter and the cranium separately. In this system, Median filter and Gaussian filter are used for obtaining better result. By patch pre-processing, output is corrected and after that clustering and segmentation processes are completed.	
[11]	2017	Prior to Non-Local Fuzzy C-Means Clustering technique, Canny edge detection technique is proposed for the segmentation. Quantifying brain structures cannot be practically accomplished by expert neuroanatomists using hand-tracing .This research depends on automated methods that reliably and accurately segment and quantify large number of brain regions.	The proposed approach consistently gives better results for various noise levels in the image compared to the reference schemes.
[12]	2017	The proposed method includes three stages. Semi Translation Invariant Contourlet Transform is used to improve quality of the original MRI in the first stage. The result of first stage is subjected to image segmentation by using Fuzzy C Means clustering method in the second stage. Finally to detect the fine edges, canny edge detection method is applied.	Our proposed method performs better because Canny method is applied for ideal input images which are improved quality and segmented in to homogeneous regions thanks to the STICTFCM.As a result, the proposed method gives a good result which presents high image quality.
[13]	2017	The proposed methodology consists of three stages i.e. pre-processing, edge detection and segmentation.This is followed by edge detection using Sobel, Prewitt and Canny algorithms with image enhancement techniques. Next, segmentation is applied to display the tumor affected region in the MRI images clearly . The image is clustered using the k-means	Computer simulations show that the improved algorithm can detect edges of pavement images effectively, and is a less time-consuming process. This algorithm can effectively eliminate noises and also protect unclear edges.

		algorithm finally.	
[14]	2017	A fast ANN based edge detection algorithm for MRI medical images is developed in this paper. First, features based on horizontal, vertical, and diagonal difference is developed. Then, Canny edge detector is used as the training output. Finally, optimized parameters including number of hidden layers and output threshold is obtained.	Results showed that the proposed algorithm provided better image quality along with three times faster processing time compared to other traditional algorithms, such as Sobel and Canny edge detector.
[15]	2016	Canny Edge Detection algorithm can be used to detect abnormal area within the gray matter area in a brain.To get more accurate result,the lower threshold and the upper threshold has to be determined cautiously .	To handle salt and pepper noise,the filter used in Canny edge detection algorithm is not enough . To eliminate noise,brain images with such disturbances has to be passed through some additional filter.
[16]	2016	The brain tumor is detected using normalized histogram and segmentation is done using K-means clustering algorithm. MRIs are efficiently classified using Naïve Bayes Classifier and Support Vector Machine (SVM) so as to provide accurate prediction and classification.	On the basis of PSNR, Median filter works best for noise removal. by calculating MSE,Averaging filter has given the best result.The proposed method has some limitations because in some tumor images, the results were not satisfactory, the detection of tumor was not accurate. The precise or accurate boundary of the tumor region could not be found out by the algorithm.
[17]	2016	The proposed ACO-based edge detection approach is to establish particularly a pheromone matrix that represents the edge information presented at each pixel of the image, according to the movements of a number of ants which are supposed to be dispatched in order to move on the image.	The proposed improvement in ant colony optimization has been successfully deployed which yields superior performance to the traditional Canny, Prewitt, Sobel, Robert, MarHildrith edge detectors.
[18]	2016	A comparative study of edge detection algorithms based on integer and fractional order differentiation is presented in this paper.For better edge detection,a soft computing technique has been applied to both algorithms.	From the simulations, it shows that better performance is obtained compared to the classical approach. Upon the addition of random Gaussian noise and addition of salt and pepper noise,the noise performances of algorithms are analyzed .From results, it is obtained that fractional edge detection with the fuzzy system performs better.
[19]	2015	The basic concepts of image segmentation is introduced	This paper has provided a brief introduction to the fundamental concepts of MRI

		to address the complexity and challenges of the brain MRI segmentation problem.Then different MRI preprocessing steps including image registration, bias field correction, and removal of non-brain tissue is explained. Finally, after reviewing different brain MRI segmentation methods,the validation problem in brain MRI segmentation is explained.	segmentation of the human brain and methods that are commonly used.
[20]	2015	Fuzzy based edge detection using K-means clustering method is presented in this paper. Various groups are generated using the K-means clustering method.These groups are then input to the mamdani fuzzy inference system. A Threshold parameter is generated, which is then fed to the classical sobel edge detector which helps in enhancing its edge detection capability using the fuzzy logic.	The retrieved results show that fuzzy based k-means clustering enhances the performance of classical sobel edge detector and also retains much relevant information about the tumors of the brain.
[21]	2015	In this paper, various preprocessing, post processing and methods like Filtering, contrast enhancement, Edge detection and post processing techniques like Histogram, Thresholds, Segmentation, Morphological operation through image processing tool available in MATLAB for detection of brain tumor in MRI images are discussed.	The preprocessing techniques include Filtering, Contrast enhancement, Edge detection is used for image smoothing. The preprocessed images are used for post processing operations like threshold, histogram, segmentation and morphological, which is used to image enhancement.
[22]	2015	Basic mathematical morphological theory and operations are introduced in this paper.A novel mathematical morphological edge detection algorithm is proposed to detect edges in medical images with salt-and-pepper noise.	The experimental results show that the efficiency of the proposed edge detection algorithm is more for image denoising and edge detection than the existing template-based edge detection algorithms and general morphological edge detection algorithms. The performance of proposed morphological edge detection algorithm is better than sobel, prewitt, Roberts and canny's edge detection algorithm.
[23]	2015	Six different edge detection based techniques (i.e.	The computational results are analyzed comparatively and tumor area is also

		Roberts, Sobel, Prewitt, LoG, Zerocross and Canny operators) for brain tumor segmentation which are validated with MRI brain images is proposed in this paper.The preprocessing step has been implemented before edge detection. This step includes Otsu's method along with global thresholding, area opening and connected component establishment.	estimated. As canny edge detector is used , the result is significantly better as compared to other operators and the distance transform result also implicates the same.
[24]	2015	An mproved Edge Detection algorithm for brain-tumor segmentation is presented In this paper. It is based on Sobel edge detection. It combines the Sobel method with thresholding method, and finds different regions using closed contour algorithm. Finally tumors are extracted from the image using information on intensity within the closed contours.	The edges generated in this paper have less false edges and have closed contours. Thus the brain tumors extracted from proposed approach are better than the tumors extracted using sobel edge detection.Furthermore,the proposed method is found to be superior compared to conventional methods.
[25]	2014	Based on segmentation and morphological operators,an efficient algorithm is proposed for tumor detection . Firstly quality of scanned image is enhanced and then morphological operators is applied to detect the tumor in the scanned image. After that, edge detection operator is applied for boundry extraction and to find the tumor size.	Achieved results show the tumor is detected efficiently by using thresholding algorithm rather than watershed algorithm and also finding the boundary extraction of tumor by using canny edge detection operator. Tumor shape and size is described.
[26]	2014	The processes and techniques used in detecting tumor based on medical imaging results such as mammograms, x-ray computed tomography (x-ray CT) and magnetic resonance imaging (MRI) is reviewed in this paper.Tumours can be identified at an expert level using computer vision based techniques in various types of medical imagery assisting in diagnosing myriad diseases.	Grayscale converted images of MRIs or CT scans is used in this research for the image segmentation process. A series of filters is used including Gaussian, linear and average filters to remove noise. Canny edge detector is used for edge detection process.

[27]	2014	An efficient algorithm is proposed in this paper which is based on higher order statistical cumulant namely Kurtosis for a class of brain MR imaging applications. A model involving the wavelet coefficient energies of the sub-bands of multi-level image decomposition and a feature set having three parameters for each band is derived	The feature set size is reduced when the proposed approach is used. A detailed look at the experimental results obtained indicates a clear improvement in the segmentation quality when compared with conventional method.
[28]	2014	The edge detection methodology presented in this paper relies on two basic stages: In the first stage, the original MRI image is subjected to image segmentation which is done using Particle Swarm optimization incorporating Fuzzy C Means Clustering technique. And secondly, for detecting the fine edges, canny edge detection algorithm is used.	PSOFCM yields better edge detected image compared to GAFCM segmentation and also it was proven that GAFCM based canny edge detection is better than ordinary canny edge detection.
[29]	2014	The method used in this paper is a hybrid approach which is a combination of watershed method and edge detection method. MATLAB is used as a tool to detect the tumor boundaries in MRI image for different cases of brain.	Tumor portion can be distinguished very clearly in this method for surgical planning. The efficiency and accuracy of the hybrid method is demonstrated by the experiments on the brain MRI images.
[30]	2014	In this paper,an automated and efficient brain tumor detection technique implementing on MRI images is proposed .Two image segmentation methods such as modified texture based region growing and cellular automata edge detection integrated in this technique.	Results show that the proposed hybrid method is more efficient than modified texture based segmentation and cellular automata edge detection. It is evident from the results, that the detection by the this method is closer to that of the manual segmentation.
[31]	2014	A scheme for tumor detection in MRI images using Hidden Markov Random Fields and Threshold techniques is introduced in this paper.	The result obtained shows a segmentation with high accuracy of MRI brain tumor images and that gives the possibility of calculating the size of the brain tumor in the future.
[32]	2013	In order to detect brain tumors, modified image segmentation techniques	Experimental results show that the proposed system out performs the conventional PNN system and handles the process of brain

		were applied on MRI scan images in this paper. Also a modified Probabilistic Neural Network model that is based on learning vector quantization with image and data analysis and manipulation techniques is proposed in this paper. Automated brain tumor classification is carried out using MRI-scans.	tumor classification in MRI image with 100% accuracy.
[33]	2013	A new method has been proposed using Cellular Automata for edge detection in this paper.The edge detection has been applied in brain for detecting cancerous cells.	Getting accurate size and location helps in surgical approaches in brain tumor treatment which includes tumor resection (complete removal) or debulking (removing as much as possible). .
[34]	2012	The methods and techniques being proposed and developed in regard of brain image analysis is discussed in this paper. Different brain image types i.e., MRI, CT, PET, EEG/MEG are also discussed in this paper.	The discussion showed that huge methods are working effectively and accurately in regard of brain image analysis but still there is need for more effective and precise work.
[35]	2012	In the proposed method 32 fuzzy logic is used for edge detection.When compared to Sobel and Canny edge detectors,it has less computational complexity in searching for edges.	Application of the proposed method on MRI of human head scans show that it detects edges in a better way than the traditional Canny edge detector and Sobel edge detector. It takes less time for edge detections.
[36]	2012	Adaptive threshold using Ant colony optimization has been proposed. ACO technique is used for computing an optimal threshold value used by adaptive threshold for edge detection.	It is inferred that when compared to other methods, the proposed method shows good result. The proposed ACO method has the better SNR performance of 24.618 which is higher compared to other existing methods.
[37]	2012	A segmentation methodology called Gradient Vector Field is used in this paper. This uses energy as the feature to segment brain tumor along with a number of standard edge detection algorithms mainly Sobel, Canny, Roberts, Prewitt and Laplacian.	This paper concludes the superiority of a particular methodology over others .It explains in detail the runtime analysis of the algorithms. This paper gives an optimized result with minimum error.
[38]	2012	A new method for brain tumor detection is developed in this work. Watershed method is used along with	From the result,it can be concluded that this developed algorithm can segment brain tumor accurately.

		edge detection operation for this purpose. Watershed algorithm is applied to the image for each region after contrast enhancement,. For output image Canny edge detector is applied. Final brain tumor segmented image is obtained after combining the three images.	
[39]	2012	A modified Probabilistic Neural Network model based on learning vector quantization is proposed in this paper. An automated brain tumor classification using MRI-scans is carried out.	The proposed system out performs the conventional PNN system and handles the brain tumor classification process in MRI image with 100% accuracy.The processing time is decreased to approximately 79% when compared to the conventional PNN.
[40]	2012	Brain tumor is detected at various levels in this paper. First, the pre-processing is done by median filter to eliminate noise and canny filter is used for edge detection, then Segmentation is done by means of histogram clustering in which the tumor affected image is divided into quadrants and threshold value is fixed, tumor is detected based on this value. Secondly, superimposing of the tumor affected with the healthy image. In the third method, the histogram is calculated and the threshold value is fixed.	The segmentation by histogram clustering and by setting threshold value combined with colored watershed management produce clear results in tumor detection.
[41]	2011	To select the best segmentation methods, the article involves an improved method. To segment the medical image, it uses three kinds of region growing methods. Canny edge detection is adopted to evaluate the performance of locating edges.	Experiment result shows that this method is very effective. It not only expands the region growing method's applying, but also gives the segmentation result more precisely.
[42]	2011	A new method of segmentation which integrates 2D Otsu method along with Canny edge detector and Region Growing is proposed in this paper. At first, the low pass filter is used to reduce the	During these experiments, it is found that this system is very compatible for much medical image segmentation. But, the interest was in brain tumor identification and we are successes satisfactory.

		noise and then to extract the region of interest Otsu thresholding method is used. In this system, Region Growing and Edge detection algorithm are executed in parallel. This system is used to identify the Brain tumor.	
[43]	2011	Based on gradient magnitude information, a new contour detection method is studied for detecting brain tumor regions. The gradient magnitude differences of the template masks and the sample masks raw pixel and perceived brightness is used to generate the contour map of the brain tumour. Then, to produce edge profiles of the brain tumor region contours, these differences are averaged and normalized.	For diverse images, no single edge detection algorithm can successfully discover edges and no specific quantitative measure of the quality for edge detection is given at present. For detecting brain tumor regions based on their gradient magnitude information, a new contour detection method is studied.
[44]	2010	A computer-based method is presented for defining tumor region in the brain using MRI images. Classifying brain into healthy brain or a brain having a tumor is first done which is then followed by further classifying a tumor into benign or malignant type. The algorithm uses neural network techniques to incorporate steps for preprocessing, image segmentation, feature extraction and image classification. Finally region of interest technique specifies the tumor area.	The obtained tumour recognition is satisfactory in view of the available limited data base.
[45]	2009	A noise-resilient edge detection algorithm is intoduced for brain MRI images in this paper. An improved edge detection based on Canny edge detection algorithm is also proposed.	Simulation results show that the proposed algorithm is resilient to impulsive noise than the traditional Canny algorithm. It can also detect more edges of MRI brain images effectively.
[46]	2000	An MRI brain image segmentation approach which is based on multiresolution edge detection, region selection, and intensity threshold	The proposed reduces noise in homogeneous region while preserving fine structures of the brain tissues. The proposed method can be combined with other image segmentation and pattern recognition techniques with a proper edginess measure and region selection in

		methods is presented here.This approach combines both spatial and intensity information of image. At first, based on a multi-scale image filtering method, a multi-resolution brain image representation and segmentation procedure is presented. The region-of-interest (ROI) image in the structure region is derived from the segmented structure, and then using our threshold selection criterion, a modified segmentation of the ROI based on an automatic threshold method is presented.	various resolutions, to increase the accuracy of the localization and quantification of brain tissues.
[47]	1995	In this paper, a method that combines region growing and edge detection for magnetic resonance (MR) brain image segmentation is proposed here.Edge information is then integrated to verify and, where necessary, to correct region boundaries.	The experimental results show that it is a reliable method for segmentation of MR brain images and for extraction tissue components of interest.
[48]	1993	For fully automated detection of brain contours from single-echo 3-D MRI data,a software procedure is presented.It was initially developed for scans with coronal orientation. Structures in a head data volume is detected in a hierarchical fashion using the procedure.	There are indications that, for quantitative analysis of MRI,an important feature in the image quality is the uniformity of image intensities. The success of all segmentation techniques which rely on image intensities depends on the degree of uniformity of the intensities over the data volume.

X.CONCLUSION

MR images are best suitable to detect brain tumours. Digital Image Processing Techniques are important for brain tumor detection by MRI images. There are two main processes to determine the existence of tumor, Image segmentation and edge detection. It can be generally concluded that this paper focuses on detecting damaged tissue with a certain intensity of brightness to its grayscale image. The thresholding will detect the damaged tissues. Through the image segmentation process, this research intends to use grayscale converted images of MRI. A series of filters can be used,which includes Gaussian, linear and average filters to remove noise. For the edge detection process, canny edge detector is commonly used in similar environments. This paper has also identified several medical limitations and contributions that can be done in future works.

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International Journal of Advances in Engineering and Management
ISSN: 2395-5252

IJAEM

Volume: 03 Issue: 01 DOI: 10.35629/5252

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